JULY 1959

Utility engineering section begins on page 37

Electrical South

THE SOUTHERN MAGAZINE OF ELECTRICAL CONSTRUCTION
Serving the 18 Southern and
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4

(Cover story, page 49)

Direct burial 33 kv cable to unit substations lowers costs, simplifies structures, and improves appearance

FIVE NEW GEDNEY PRODUCTS . . .

"that fit always!"

Nobody knows better than you do how much time, trouble and expense are involved when electrical fittings don't fit properly. That's why Gedney has adopted the simplest of mottoes: *Gedney Fittings fit.* And we mean it!

Gedney Fittings are machined with unfailing accuracy, then carefully finished, finally they're scrupulously inspected. *Result?* You no longer have to make allowances for the fittings (and time) you used to throw away! One more thing. These better fittings cost you no more!

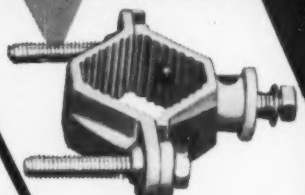
Think of all the places you can save time and money with these five new Gedney Fittings and Accessories!

GEDNEY INSULATED MALLEABLE IRON BUSHINGS (cadmium-plated). Polyethylene collar is free to turn while bushing is tightened. . . prevents binding, twisting, during installation. Sizes ½" to 6".

GEDNEY JUMPER WIRE BONDING BUSHING. Solderless lug. Malleable iron, cadmium-plated, available sizes ½" to 4".

GEDNEY INSULATED MALLEABLE IRON GROUND BUSHINGS (cadmium-plated). Solderless lug. Free-turning polyethlyene collar prevents binding, twisting, of conductors. Sizes ½" to 4".

GEDNEY PUSH-PULL TAB CAP. For plugging bushings, etc. Use again and again. Strong polyethylene, in sizes ½" to 2".



GEDNEY STATIC PREVENTIVE GROUND CLAMPS. Made to ground pipe or conduit from ½" to 8".

GEDNEY FITTINGS FIT

GEDNEY
ELECTRIC COMPANY

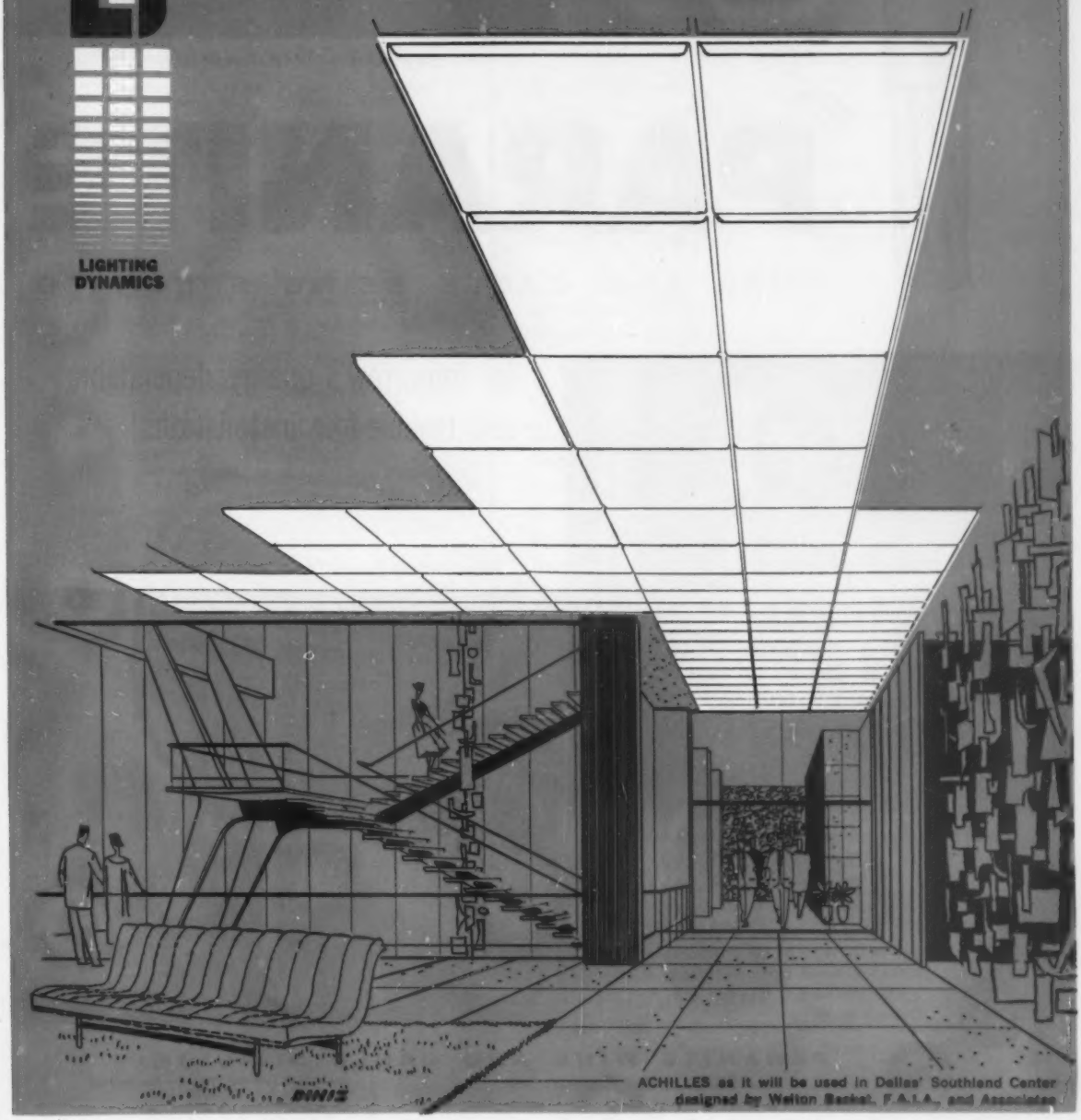
RKO BLDG. • RADIO CITY • NEW YORK 20
Foundry, Factory and Shipping Point: Terryville, Conn.

problem solution

An easily maintained, integrated fixture was needed for Welton Becket's dramatic "squares of light" ceiling in the lobbies and offices of Southland Life's spectacular 42-story Southland Center in Dallas.

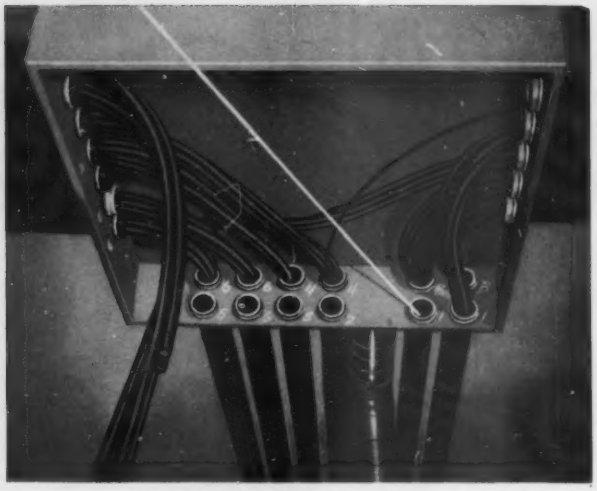
ACHILLES by Lighting Dynamics was specified for the lobby... and it's companion Apollo was used in the offices throughout the center. Achilles is a highly versatile fixture series ideal for this demountable acoustical ceiling—just as it is for countless other ceiling suspension systems. It's quickly installed with a drop-in installation and has easy maintenance with press-to-open catches and hook-on hinges. Durable, Bonderized and electro-static, high-reflectance finishes... FOR MORE COMPLETE INFORMATION, call your Lighting Dynamics representative, or write to Lighting Dynamics, 802 West Whittier Blvd., Whittier, California or Lighting Dynamics, 8700 Ambassador Row, Dallas, Texas.

LIGHTING DYNAMICS



ACHILLES as it will be used in Dallas' Southland Center designed by Welton Becket, F.A.I.A., and Associates

To meet today's ever increasing power demands...

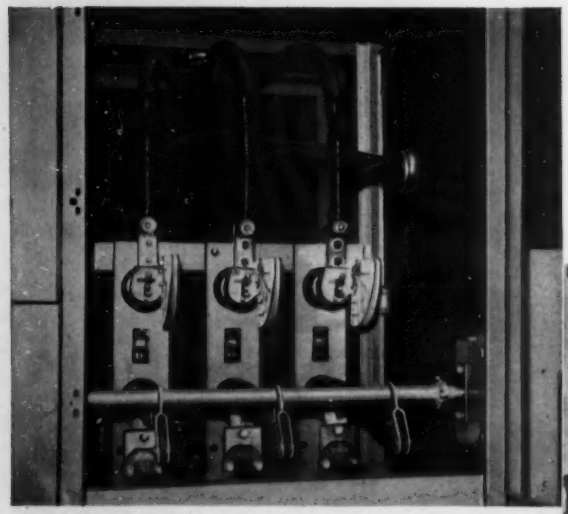


Paranite Paraseal® RHW, Type RR for duct.

IT'S

PARANITE

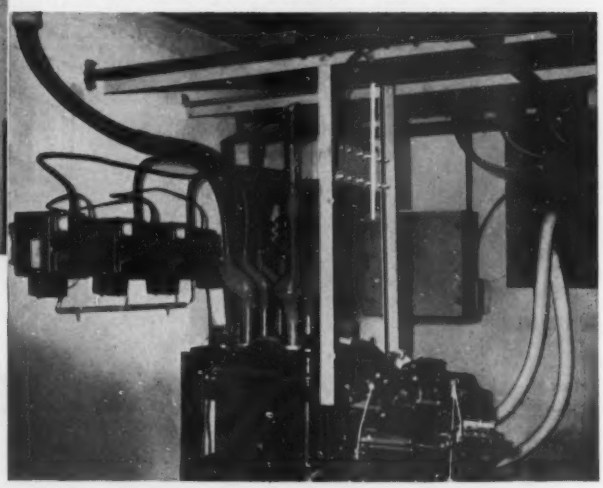
WIRE AND CABLE BEING SPECIFIED



Above: Super Parause® RHW, Type RR for direct burial.

for tomorrow's quality, dependable and trouble-free installations!

Below: Paranite Paraseal® RHW braided, for use in conduit.



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MANUFACTURING PLANTS: Marion, Ind.; Jonesboro, Ind.; Tiffin, Ohio; Birmingham, Ala.; Anaheim, Calif.

ELECTRICAL SOUTH

SERVING THE 18 SOUTHERN AND SOUTHWESTERN STATES

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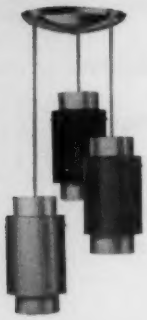

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Six Standard Kits Cover Most Installations

These Weaver Mast Kits provide everything needed for low roof service entrance installation except the conduit. All parts are designed for easy installation without tools. Six standard kits cover most installations or, on request, Weaver will pack special kits. Individual items may, of course, be ordered to meet local requirements.

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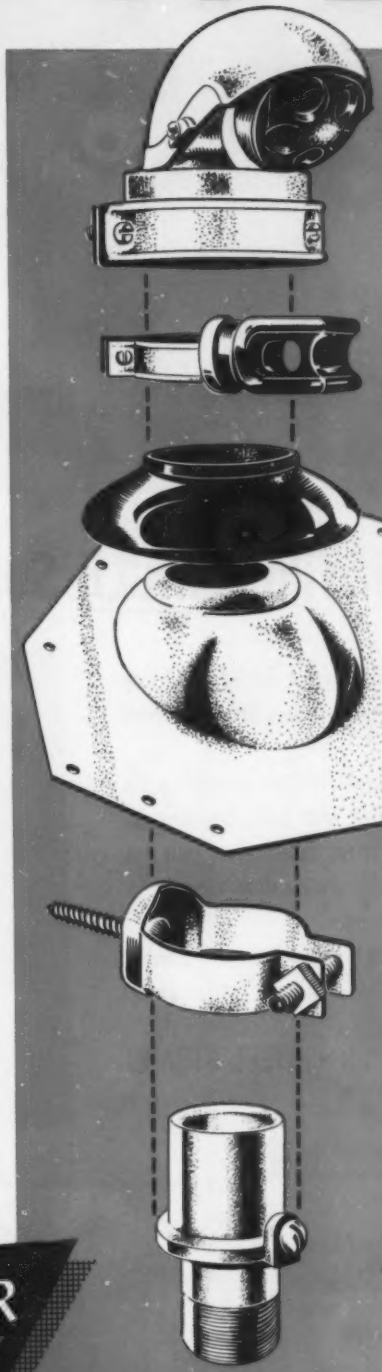

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Neoprene storm collar eliminates caulking . . . assures lifetime protection against leaks.

FLASH PLATE
Supports mast and serves as flashing.

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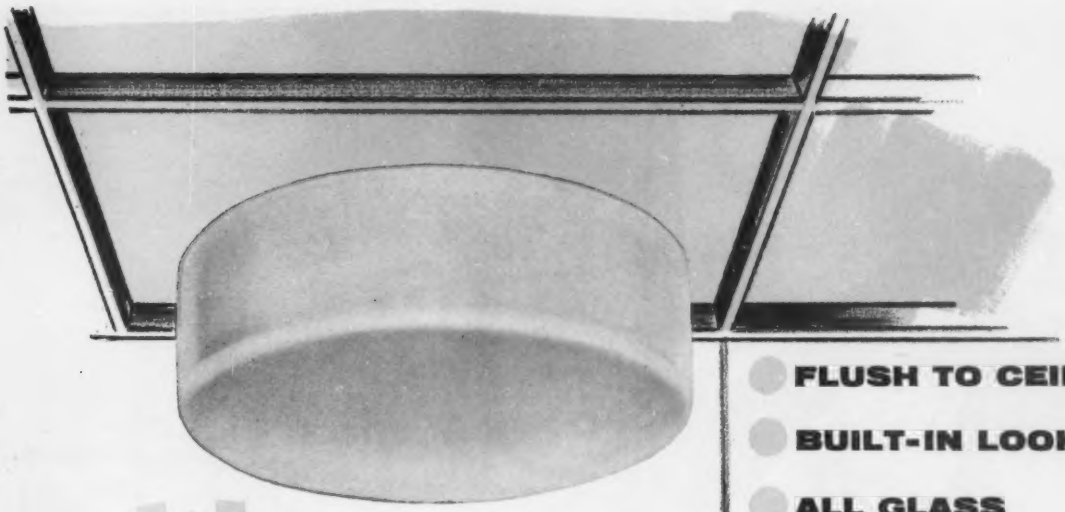
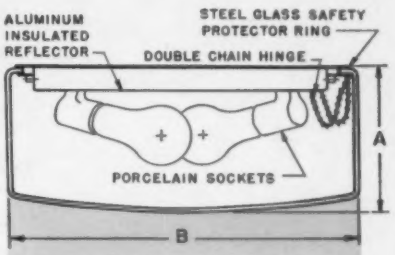


Klondike

by PERFECLITE

- **FLUSH TO CEILING**
- **BUILT-IN LOOK**
- **ALL GLASS**
- **ALL LIGHT**



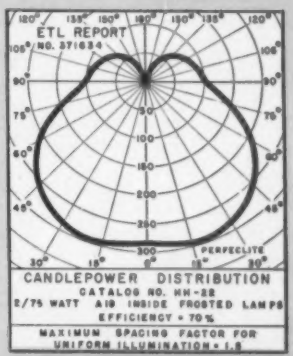
Cat. No.	Wattage	A	B
HH-21	2-60W	5⅜"	10"
HH-22	2-75W	5⅜"	12"
HH-23	2-100W	6⅜"	14"
HH-24	3-100W	6⅜"	16"

No metal shows, nothing projects on the Klondike*, Perfeclite's latest incandescent ceiling unit. Mounted absolutely flush, it allows maximum utilization of the opal globe for the highest light efficiency available . . . gives that built-in look without costly recessing.

The globe opens on a double chain hinge for quick, easy cleaning and relamping . . . is secured in place again with a simple twist of the wrist by a unique patented locking device. Interior construction is of 20-gauge steel. The reflector is faced aluminum. The multiple porcelain sockets are equipped with #18 A F leads for direct connection to Types R, TW or any 60° C rated wire.

Here at last is a totally new concept in fixture design . . . a totally new way to provide better lighting for either commercial or residential interiors. For further information, mail the attached coupon today!

Units are Underwriters' Laboratories, Inc., approved.



*Patented

THE PERFECLITE COMPANY
1457 East 40th Street • Cleveland 3, Ohio

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1457 East 40th Street • Cleveland 3, Ohio
Please send me the Perfeclite Data Sheet 59-C.

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ADDRESS _____

CITY _____ STATE _____

USS Tiger Brand Amerclad Cables are built tough and strong to withstand dragging over sharp rocks, and exposure to sun, rain, grease and oil.

Right—Strength and flexibility of Amerclad are shown by its use over this cable bridge leading to a power shovel.

Far right—Vibration resistance of the Amerclad Cable is the main reason for its use on this railroad track tamping machine.

USS

Tiger Brand Electrical Wire & Cable

A standard cable for every special job

- Asbestos Wire and Cable
- Mold-Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

What's the difference in electrical wire and cable?

Even though electrical cables may look alike and start with some of the same materials, there's a *real difference* in the completed cables.

The difference in USS Tiger Brand Amerclad Cables results from a combination of research, engineering and construction. The development of better materials goes on constantly at American Steel & Wire. Insulation and jacketing compounds have been improved.

Better stranding designs and methods of stranding add years to cable life.

Amerclad Cables are protected by an outer jacket of Amerprene, an oil resistant compound containing a high percentage of Neoprene. Before being vulcanized, an Amerclad Cable is encased in a substantial lead sheath that is afterward removed. The pressure developed within this rigid mold during the vulcanization process produces a dense, non-porous jacket that is highly resistant to abrasive wear.

Knowledge of severe field conditions obtained through sales engineers permits designing for special conditions.

Constant effort to control quality and improved methods of inspection assure a product of highest quality.

These are a few of the unseen plus values you get when you buy Tiger Brand Amerclad Cables for your shovels, dredges, continuous miners, drills, shuttle cars and other equipment. For complete technical information, write for our free book, "Tiger Brand Amerclad Cord Cable," American Steel & Wire, Room 9161, 614 Superior Ave., N.W., Cleveland 13, Ohio.

USS, Tiger Brand and Amerclad are registered trademarks

American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
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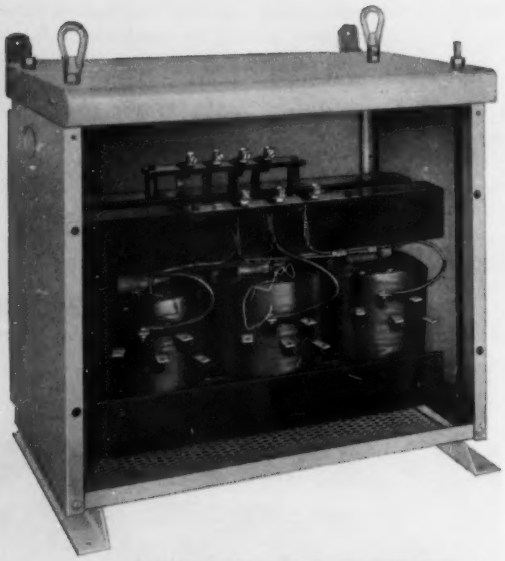
When you select dry-type transformers initial costs can be false economy

SORGEL
SOUND-RATED DRY-TYPE
TRANSFORMERS



45 Kva 3-phase transformer with taps. Interchangeable wall or floor mounting. Front panel removed, showing interior.

COMPLETE LINE FOR EVERY PURPOSE up to 10,000 Kva, up to 15,000 volts, including special transformers and saturable reactors.

The same quiet SORGEL transformers are also incorporated in substations. Procurable with any type or make of switchgear, or from any electrical manufacturer.

The first cost of dry-type transformers is not always the final cost. Don't be misled; the lure of lower prices often camouflages operating and installation costs. SORGEL SOUND-RATED DRY-TYPE TRANSFORMERS are designed and constructed for long life. They provide the absolute ultimate in operating efficiency, ease of installation, overload capacity and long-range economy.

SORGEL offers these proven advantages

LOWER COPPER LOSS — Coils are liberally designed for the most effective use of the latest developments in insulating materials, have large air ducts for low hot spot temperature and are vacuum-impregnated to provide a co-ordinated insulation system.

LOWER CORE LOSS — Cores are designed with the industry's lowest magnetic flux densities, resulting in low core loss and the lowest sound level. The entire unit is secured within a substantial frame. Large units are mounted on vibration dampers to minimize vibration transmission to adjacent areas.

QUICKER AND EASIER INSTALLATION — The enclosure is self-supporting and entrance can be made on sides, top, bottom or back. Connecting is made easier by means of solderless connectors on terminal blocks in roomy connection compartments. Units up to 75 Kva single phase and 45 Kva 3-phase, are furnished for interchangeable wall or floor mounting.

Over 43 years experience in the development, manufacturing and application of transformers, has made these achievements possible.

You will be doing your company or customer a great service when you select the best dry-type transformer made only by . . .

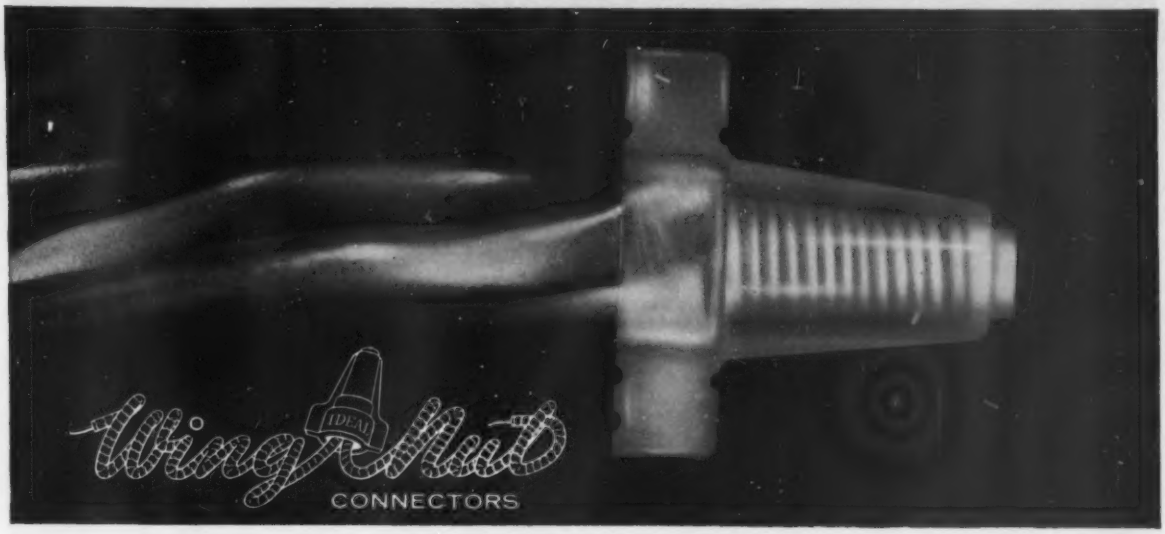
Sorgel Electric Company

835 W. National Avenue, Milwaukee 4, Wisconsin

Sales engineers in principal cities.

Consult the classified section of your telephone directory or communicate with our factory.

NEW WIRE CONNECTOR



At last -- a really easy way to join heavy gauge, hard wires!

BUILT-IN-WRENCH

New wings make it 50% easier to screw on, even on new stiff vinyl-insulated #6 wire. Wings eliminate wrenches; can be snipped off after applying.

"PYTHON GRIP"

New internal tension-spring coils adapt to shape and size of wires—apply tremendous pressure evenly over entire stripped area. Pressure is so great wires are threaded and crushed together.

NYLON SHELL

Insulating cap is Nylon . . . high dielectric, unbreakable and abrasion resistant. You can actually see your splice inside the semi-transparent Nylon shell. Compact—uses less space in junction box. U.L. approved for recessed fixture wiring because Nylon shell withstands 105° C.

Actual size Models 452 and 453. Both "WING-NUT" Connectors approved as pressure cable connectors, for general use (600 V) in branch circuit and fixture wiring.

New IDEAL "WING-NUT" Connector gives you the easiest yet most perfect mechanical connection possible. Wide skirt opening makes it easy to connect larger combination wires (example: two #8 with a #6) as well as the thickly insulated Type R wire.

The new "WING-NUT" Connectors handle 336 possible combinations of solid or stranded wire . . . almost twice the number of other single piece Connectors. "WING-NUT" is available in two sizes.

Ask your electrical distributor about his special introductory offer.

MAIL THIS COUPON

IDEAL INDUSTRIES, INC.
1017-G Park Ave., Sycamore, Illinois

Yes, I want complete catalog data on the new "WING NUT"

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Company_____

Address_____

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IN CANADA:
IRVING SMITH, LTD., MONTREAL

IDEAL
THE HELPING HAND ON EVERY WIRING JOB

Sports lighting requires a combination of short-range and long-range floodlights to provide good visibility for participants and spectators, and to add dramatic effect. Economical Revere Eliptor floodlights on Revere hinged poles illuminate this race track. Revere "2000" Series long-range, rear-serviced floodlights are mounted on the grandstand roof to increase intensity of illumination at the finish line.

Solve any outdoor lighting problem with Revere's complete, matched line

Peak lighting efficiency for any outdoor lighting application calls for a number of components, each designed to do a specific part of the job. Solving outdoor lighting problems is much easier when you install Revere equipment because—

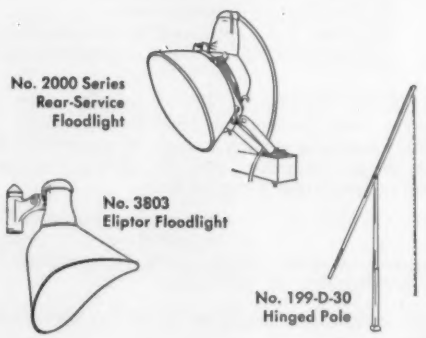
1. Revere offers the widest line, making it easy for you to select the exact combination of components to solve *any* outdoor lighting problem. Everything you need from one reliable source simplifies ordering, assures on-schedule delivery of all components.

2. Revere offers matched components . . . *structurally* matched for strength, balance, and perfect fit; *design* matched for peak lighting efficiency and best appearance.

3. Revere offers easier installation—lights, poles and accessories are made for each other. Installation is fast, easy, trouble-free.

Write for Revere's catalog of outdoor lighting equipment. You can solve any outdoor lighting problem with this complete, matched line.

Revere components used to light race track



Revere ELECTRIC MFG. CO.

OUTDOOR LIGHTING

Revere Electric Mfg. Co. • 7420 Lehigh Avenue • Chicago 48, Illinois (In suburban Niles)
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In Canada: Curtis Lighting, Ltd., Leaside, Toronto, Ontario

Watson-Flagg figures costs closely

Garden State Plaza Shopping Center, Paramus, N. J. Watson-Flagg Engineering Co., electrical contractor

but doesn't take chances!

"I've been connecting with Burndy for 30 years. They go on fast and they don't work loose. I know I don't have to worry when a job's connected with Burndy."

BEN KAHN, WATSON-FLAGG (Paterson, N. J., office)
superintendent in charge of Garden State job.

The performance of every piece of electrical equipment on the Garden State Plaza job depends on the performance of the electrical connectors, yet these connectors accounted for less than ¼ of 1% of the total electrical job. For less than ¼ of 1%, Watson-Flagg didn't take a chance ... they installed only Burndy connectors.

Garden State Plaza opened without a hitch, and Watson-Flagg is now installing Burndy connectors on the expansion planned to make it one of the largest shopping centers in the country with a power system of an ultimate 18,000kw capacity.

The reputation of a contractor depends on the quality of his jobs and for less than ¼ of 1%, it doesn't pay him to take a chance on the quality of the connectors he installs. More than 30 years experience has taught contractors that they don't take chances when they connect with

BURNDY 58-29

Norwalk, Connect. In Europe: Antwerp, Belgium Toronto, Canada

PUT FULL HOUSEPOWER TO WORK

Fast Recovery For Faster Selling, Greater Loads

Water heaters, with an average annual load factor of 47% and an average annual usage of 3600 KWHR, build loads and profits better than any other household appliance. And, to help you add more of this important business to your lines, Hotpoint offers 40-gallon round and table-top models with the fast recovery today's consumer demands. They provide 470 gallons of hot water every 24 hours—more than 6 times the average family's daily requirements. And, they save space and money by eliminating large storage tanks. Display and promote Hotpoint fast-recovery water heaters for greater earnings.

Model WBA42-1

15-YEAR WRITTEN PROTECTION PLAN ON DELUXE MODELS

One-year warranty on the complete heater, and an additional 7-year replacement warranty on the tank, plus an additional 7-year tank exchange plan. 10-year written protection plan on "Silver Line" Models.

Additional Hotpoint features your customers will want:

LIVE BETTER ELECTRICALLY

MIRACLE MLC-7 ADDITIVE fights rust and corrosion, can lengthen tank life as much as 200%, depending on condition of water.

GENUINE CALROD® MAGIC CIRCLE® HEAT—the most widely used heating units in the world. Famous for efficiency and long life.

PROVEN LEADERSHIP—over ⅓ of all electric water heaters have been made by Hotpoint, and less than 1% have ever needed service.

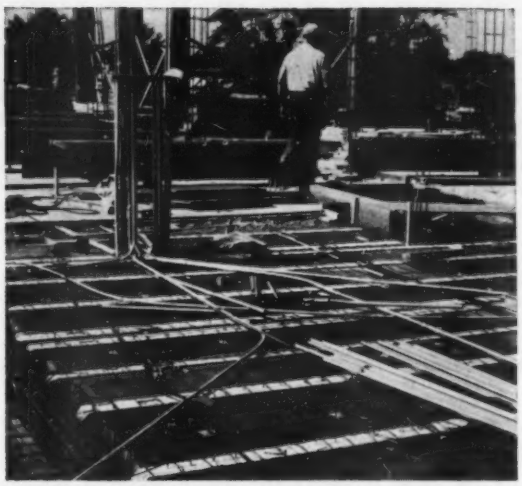
LOOK FOR THAT **Hotpoint** DIFFERENCE

A Division of General Electric Company, Chicago 44, Illinois

Installation: Jewish Community Center, Detroit, Michigan
Architect: Paul Tilds & Associates
A. Woronoff, Supervising Architect
Contractor: Lerner-Linden Construction Company
Electrical Contractor: Donn Resnick Electric Company

IN COMMUNITY SERVICE CENTER, DETROIT

THE BEST COSTS LESS INSTALLED



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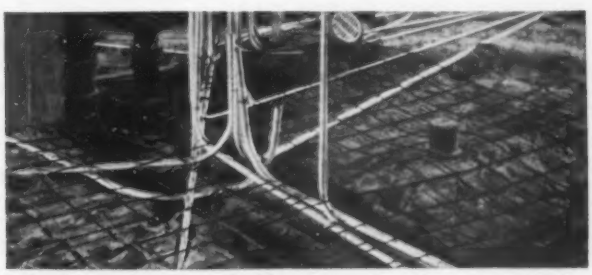

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Economic comment

by J. Whitney Bunting, Ph.D.
Contributing Economics Editor

What sparked the recovery?

Economists for the most part look at today's business activity with a wary eye. It is not so much that they disbelieve the signs of economic strength on all sides but rather that they cannot agree on the factors responsible for the quick recovery. It has been only a year ago that the problem of what steps to take to prevent a depression was uppermost in business and governmental minds.

Almost before any firm remedial action could be developed, the economic scene began to clear, and activity slowly but surely commenced to take over. Reports today, from business and government sources alike, indicate that the economy is once more on a firm up-grade.

In fact, it now appears as if productivity, employment, and a host of other important factors may be heading for an unprecedented era of prosperity. And yet the factors that brought this about are still matters of conjecture for many.

A growing number of economic thinkers are now reporting the importance of private business initiative as the spark that stopped the recession and brought on the present economic upsurge. If this is true, and it would be a most welcome fact if it were, then it would provide the strongest type of support for the theory of the free enterprise system.

Ever since 1929 (and possibly before), there have been many fair weather friends of the free enterprise system. When times were good with employment booming and industries operating on full schedules, there was much support for the principles of freedom applied to the economic system. However, when a slow-down appeared on the horizon and recessions or depressions took hold of economic activity, considerable confidence was lost in the smooth workings of the free economic system. It was always at this point that the government was called upon to take some action to stop the decline and to institute some form of corrective pump-priming measures.

In 1958, the calls for this type of action were many. Politicians, economists, and some businessmen felt that massive federal action was necessary. Labor officials called for prompt action to lessen the effect of unemployment which seemed to be increasing daily. Congress and the White House were subjected to extreme pressure for prompt remedial action. It was at this point that private interests took over.

Dr. Bunting is a well-known economist and educator having special knowledge of the South.

Private interests take over

By the recognition of the fact that industry must offer real value at the lowest possible prices, many producers went to the people with a value that could not be rebuffed. The customer became the central target for sales, for production, and for service.

Purchasing power was still high in spite of the spotty unemployment situation. Inventories that had seemed to rise at a phenomenal rate soon began to dwindle because the public bought when it recognized value.

Above all, confidence was expressed at the market place—confidence of businessmen in the future of merchandise and service offered for sale.

Both of these factors would have been seriously undermined if a massive governmental support program had been instituted, for such a program often breeds fear instead of confidence. Thus, positive action by all segments of the economic society without governmental intervention is the soundest way to build a secure economy with benefits for all.

The favorable reports of the present economic scene are now a matter of record. The status of unemployment, while still a problem in localized areas, is now at the level of three and one-third million persons. Indications are that this figure will continue to shrink even more through the end of 1959. If it should reach the neighborhood of two million persons this phase of the industrial picture will be at the best level in many years.

At the same time, employment has reached record proportions. As of May, 1959, employment has reached a point in excess of sixty-six million persons. Couple this important statistic with greater average earnings per person employed, and the net result is a mushrooming ability to buy goods in the nation's stores and markets. This consumer optimism is being registered daily as more and more sales records are being achieved by all types of outlets.

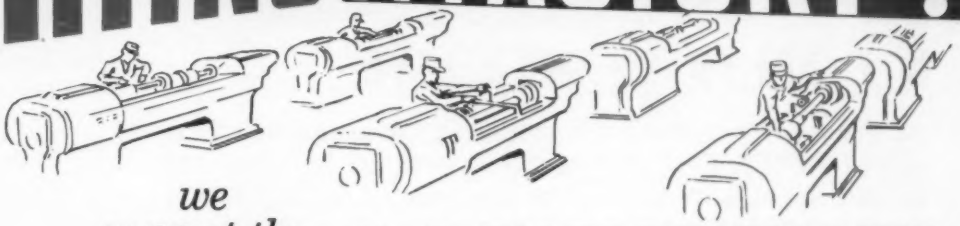
Moreover, as of this moment, there appears to be a strengthening of price stability. Under conditions mentioned above there is always the inherent danger of strong inflationary forces in the price structure. This may yet come in another round of price-wage boosts, but at the present writing these forces appear to be rather well-contained.

Stock price trends

The stock market should continue to advance slowly and with periods of irregularity. This, of course, is largely due to the normal factors of supply and demand although the long term forces look good for industrial and business expansion. Securities in the growth-industry category, where full use of technological advance is being made, seem to weather the irregular price trends remarkably well showing a consistent steady upward climb in the face of sporadic market declines. There is no real evidence that this situation might change or be modified in the next twelve months ahead.

(Continued on page 129)

LIGHTING A FACTORY?



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APPLICATION:

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CONSTRUCTION:

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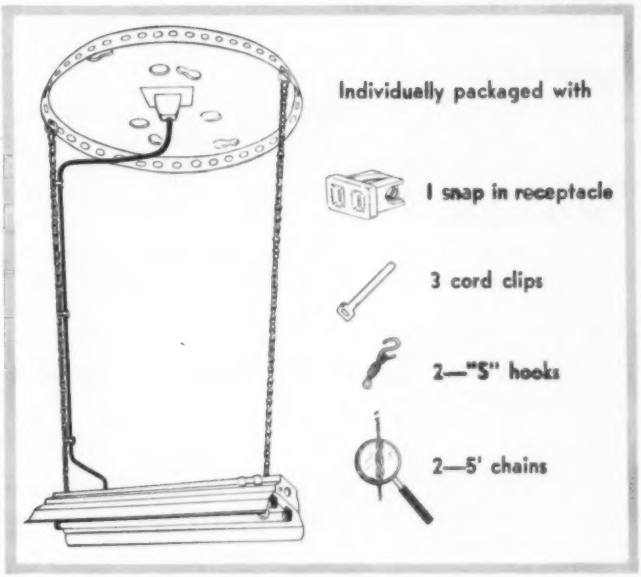

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MOUNTING:

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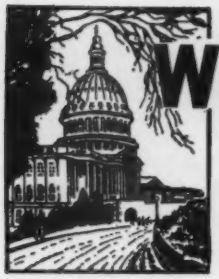


Washington report

By Jack James

Digest of Washington news of special interest to the electrical industry

North Texas contractors sign two-year pact

Members of the North Texas Chapter of the National Electrical Contractors Association have agreed to raise pay for electricians 12½ cents an hour on Aug. 1, and 12½ cents an hour again on June 1, 1960. The two-year contract is with IBEW Local 116. The pact covers 11 northern Texas counties. Journeyman's scale will be $3.50 an hour on Aug. 1. In addition employers pay 7½ cents an hour for health and welfare. (This report is based upon figures released by the IBEW.)

* * *

Apprenticeship paves the way to advancement

More than one out of every four apprentices who graduated from formal apprentice programs as electricians in 1950 within six years advanced to foreman, supervisor, or employer.

This fact is revealed by figures compiled by Joseph H. Schuster of the Bureau of Apprenticeship, U. S. Department of Labor. Schuster sent questionnaires to a representative group of journeymen who completed apprenticeships in 1950. Among the questions was one about what they did in 1956.

The answers reveal that if in 1956 you had talked with an average group of 100 electricians from the graduating class of 1950, you would have found 21 foremen and supervisors, 5 contractors and employers, and 72 journeymen.

Here are some other facts that you could have learned about this average group of 100:

The electrician's trade runs in a family's blood. Twenty-five of the journeymen were in the same trade as their fathers.

Ninety-one of these journeymen electricians had studied at high school and 66 of them graduated—more high school graduates than you would find in any similar group in a construction trade.

Ninety-two were veterans of whom 86 received GI assistance while apprenticing. Fifteen would not have been able to complete their apprentice training had it not been for this assistance.

Parents or relatives thought so highly of the electrician's trade that they urged 55 to apprentice. Employers spurred on another 16, and union officials another 17. Teachers and vocational counselors at high school also were important.

Forty-three of the journeymen went directly to employers and asked to apprentice; 30 applied to unions; 12 went to joint apprenticeship committees. The rest used other methods.

Contractors who want to read Schuster's report can find it in *Construction Review*, a monthly magazine of the U. S. Department of Labor. Look in the May issue. Local contractors' associations might have copies.

* * *

Jacksonville contractor reimburses dues, dobies

BECAUSE of allegedly illegal union agreements which he never agreed to, a Jacksonville, Fla., electrical contractor may have to reimburse jointly with a local union, dues collected from electricians on a construction job in Georgia.

Trial Examiner James T. Rasbury of the National Labor Relations Board recommended this penalty. The board has not yet decided.

The case involved Satchwell Electric Construction Co. of Jacksonville, Fla., which had a contract with Local 177 of the International Brotherhood of Electrical Workers at Jacksonville, and Local 508 of the IBEW which had jurisdiction at Brunswick, Ga.

Satchwell had a contract with the Brunswick Pulp and Paper Company to do some work. As is customary, the contractor hired electricians through the IBEW local which had jurisdiction, Local 508.

Local 508 had agreements with other contractors in which Trial Examiner Rasbury found illegal hiring arrangements. Rasbury also found that Satchwell's agreement with the Jacksonville IBEW Local 177 incorporated Local 508's agreements when Satchwell worked in this local's jurisdiction. Therefore Satchwell was hiring electricians illegally, Rasbury concluded.

The trial examiner declared the point raised by company and union attorneys—that Local 508 had only an oral arrangement to supply electricians to Satchwell—was not a good defense.

Here are the key points which Trial Examiner Rasbury made:

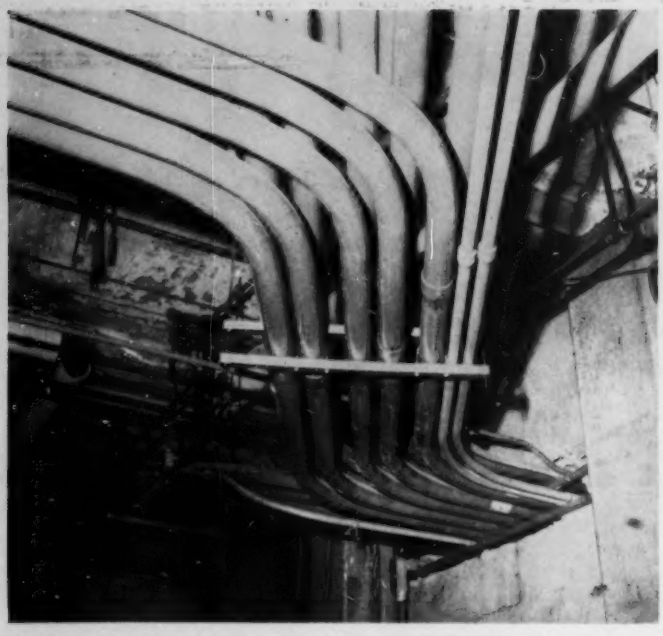
Article II, Section 9 of the agreement between Satchwell and IBEW Local 177 at Jacksonville states: " . . . any violation or annulment of working rules or agreement of any other local union of the IBEW . . . will be sufficient cause for cancellation of this agreement with the individual employer involved."

At Brunswick, Ga., agreements of Local 508 with contractors contained this statement:

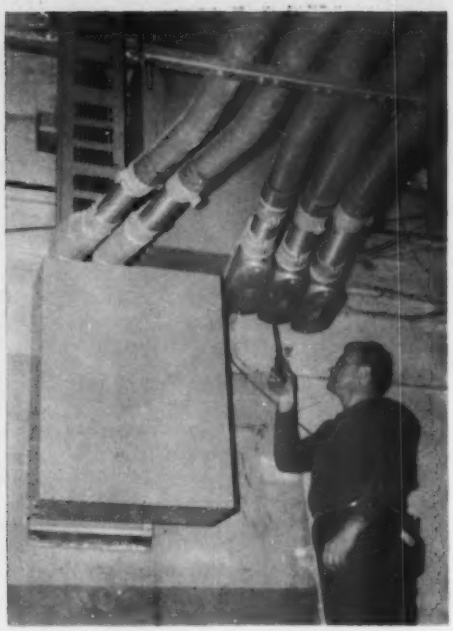
"The employer shall hire only workmen who are referred to them from the local union, but should the union be unable to furnish the employer with workmen within 48 hours of the time the union or its representatives receive the request, the union shall issue temporary work cards to workmen who apply and are recommended by the employer, until such time as the union can furnish workmen and give the employer 48 hours notice for such replacement."

Rasbury asserted that since the employer could hire only em-

(Continued on page 127)



Feeder conduits for power and air-conditioning branch out from switchboard to serve electrical needs in all three buildings.



Feeders from main panel form junction with busway risers at tap box.

Plug-in busway

By C. M. Whalen

President
Allen and Whalen
Rockville, Md.

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers
- Consulting Engineers ✓

◆ ORIGINAL CONTRACT drawings for a recent job, which involved the conversion of a former three-wing hospital into an air-conditioned government office building, specified multiple conduit risers feeding respective lighting and air-conditioning or power circuit breaker load centers.

To eliminate the necessity for a mass of large junction boxes and splicing equipment, we substituted plug-in busway risers. The result was a job satisfactory to all concerned— attractive and adequate —and one which proved substantially cost-saving in labor while material costs remained approximately the same.

Moreover, the use of a busway with plug-in features provided flexibility for future increases in capacity.

The hospital consisted of a ten-story center building connected by enclosed passageways to adjoining buildings of eight and nine stories. The ages of the three buildings ranged from 40 to 60 years.

At the beginning of the work, we removed all existing electrical installations. Following the original contract drawings, junction boxes through which the risers pass would have been necessary at each floor to feed the panels on that floor. As designed, the group of power feeders would have consisted of three 3½-inch conduits, each of which would contain three 500 MCM phase conductors and one 250 MCM neutral conductor. The lighting riser called for two 3½-inch conduits, each containing four 350 MCM cables.

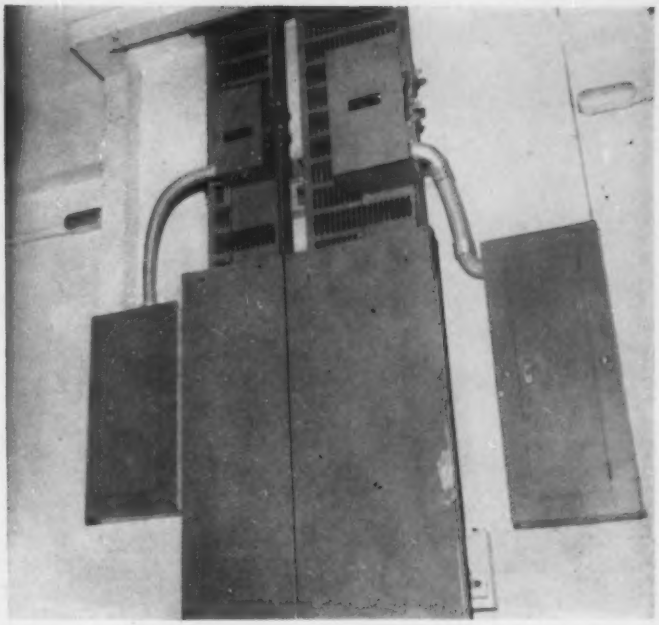
Instead of vertical conduit risers from the basement to the top floor of each building, with large and deep junction boxes at each floor, the necessary grouping of phase conductors, and consequential feeder taps for the panels, a system of plug-in busway risers of 1,350 ampere capacity for power and 600 ampere capacity for lighting were substituted.

Since plug-in busway risers were located in public corridors, it was necessary to provide protection both to busways and to personnel using the corridors. Therefore, we covered the busway from floor level to a point six feet above with metal cowlings provided by the supplier. These are clamped to the busway and are removable once their purpose is fulfilled. Plug-in units were then installed above the six-foot level to eliminate unauthorized operation.

At each floor elevation plug-in main circuit breakers were installed to feed branch circuit load centers of circuit breaker type. More compact and less of a corridor obstruction, the risers presented a much more attractive appearance in the corridor.

Each of four elevators is fed by separate 225 ampere circuit breakers. Also, pressure boosting water pumps and associated control

Job Superintendent A. B. Culpepper demonstrates switchgear on main switchboard.



Lighting busway is at left and power on right at this power take-off location. Circuit breakers feed branch circuit panels.

substituted for multiple risers

equipment are served by their own 200 ampere circuit breakers. Emergency lighting is served by a 60 ampere main switch feeding a 12-circuit panel of the circuit breaker type.

Through our use of plug-in busway risers as a source of power at each floor, capacity available to that floor may be increased at any time the need arises by replacing the present plug-in circuit breaker with one having a larger amperage rating.

In addition, a separate circuit breaker may also be installed for completely separate or unrelated loads such as electronic computers, cafeteria and kitchen equipment, etc. This arrangement, therefore, allows flexibility of load adjustments at each floor.

Also, under the system installed voltage drop from source to extreme end of a busway run is reduced, making areas removed from the main service source as efficiently served as those nearer to it.

Another change from the original contract requirements calling for all branch circuit runs in electrical metallic tubing was the substitution of a 4 x 4 wireway to collect and conduct all branch circuit conductors from the branch circuit panels along corridors to a point outside of rooms actually being served. Electrical metallic tubing is used only in the individual rooms and terminates in the wireway serving the rooms, avoiding unsightly and costly multiple parallel home runs to the panel. If a wireway had not been used as a collecting device, approximately 20 to 40 tubes would have been exposed in the public corridors. Because of job conditions all branch circuit wiring had to be exposed.

One problem encountered by the use of a wireway to group all home runs was that of exceeding the allowable Code limit of 30 conductors in one trough. Since our branch circuit conductors are of No. 12 gauge, we placed a metal divider into the 4 x 4 wireway, creating, in effect, two wireways in one, each with an allowable 30 conductors.

Our new electrical service is supplied to a 4000 ampere switchboard with 4000 ampere main disconnect, which in turn controls all electrical services in the three buildings. Lighting service for each building is provided by a 600 ampere circuit breaker. Power and air conditioning feeders to each building are supplied by a 1200 ampere circuit breaker.

In this particular installation labor requirements for installing a busway riser system were considerably less than for a system similar to the original design. Complex junction boxes would have required costly time-consuming labor operations, such as that involved in handling heavy conductors at every floor. The busway riser system provides access to the current-carrying buses by means of plug-in devices, which required a negligible amount of labor. Since there are 54 such plug-in units serving all floors, the savings realized become appreciable.

This installation is an example

(Continued on page 124)

What's wrong with high intensity lighting?

By Ernest F. Siegel

Chief Mech.-Elec. Engineer
Green and Associates, Inc.
Baltimore, Maryland

This article should be especially helpful to the following readers:

- Electrical Contractors
- Electric Utilities
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

◆ IF THIS QUESTION were asked at a gathering of illuminating engineers the answer might be a resounding "nothing." Similar answers would undoubtedly be forthcoming from representatives of our utility companies, from the advertising and display craft industry, and from our manufacturers of luminaires, lamps, cable, conduit, panelboards, etc. In short, anyone who would put forth any argument against high intensity lighting would place himself in the corner with the fellow who argued against motherhood.

And yet, under somewhat closer scrutiny, the resounding battlecry for "more footcandles" deserves analysis. I would answer the question "nothing, but . . . " The "but," primarily put forth by the fraternity of mechanical engineers who design air conditioning systems within strict budgets for buildings in which the internal heat load from lighting increases rapidly from year to year.

The "but" is also advanced by the owners of buildings who must foot not only the bill for the additional kilowatts required to feed the insatiable demand of the footcandle race but must also pay an increased initial cost as well as substantially increased operating costs for their air conditioning systems.

Another "but" comes from a rather strange source in the engineering field, but one which will have an increasingly important impact on lighting design, namely, the industrial psychologist.

In many cases we have, of late, counted footcandles and worried about diminishing additional glare, but we have forgotten the individual who is exposed to our increased lighting intensity. We have added row upon row of clinically-clean looking and highly efficient fluorescent lamps and have not considered that these straight linear patterns of narrow spectrum lighting produce boredom and induce a tired feeling in the potential users, according to industrial psychologists.

What then can be done to alleviate these conditions?

There appear to be several means by which the increased heat output of the fluorescent lights can be dissipated by ways and means that are considerably cheaper than refrigeration compressors. If all the ballasts for a particular area were combined in one small utility room and this

(Continued on page 129)

Wiring a circular dome building

By Olen J. LeBlanc

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electric Utilities ✔
- Electrical Wholesalers ✔
- Electrical Inspectors ✔
- Industrial Engineers ✔
- Consulting Engineers ✔

◆ ONE OF THE MOST UNUSUAL jobs ever performed by a contractor in the South was recently completed by Sachse Electric, Inc., at the fabulous Union Tank Car Dome, at Baton Rouge, La.

This building, which has attracted world wide attention, is the largest circular structure in the world. Built entirely of steel and with no windows whatsoever, the problem of lighting represented one of the most important phases in the entire construction of the unique building.

The dome itself rises as high as a ten story building with an overall diameter of 384 feet at the base and encompasses 110,000 square feet of unobstructed floor space.

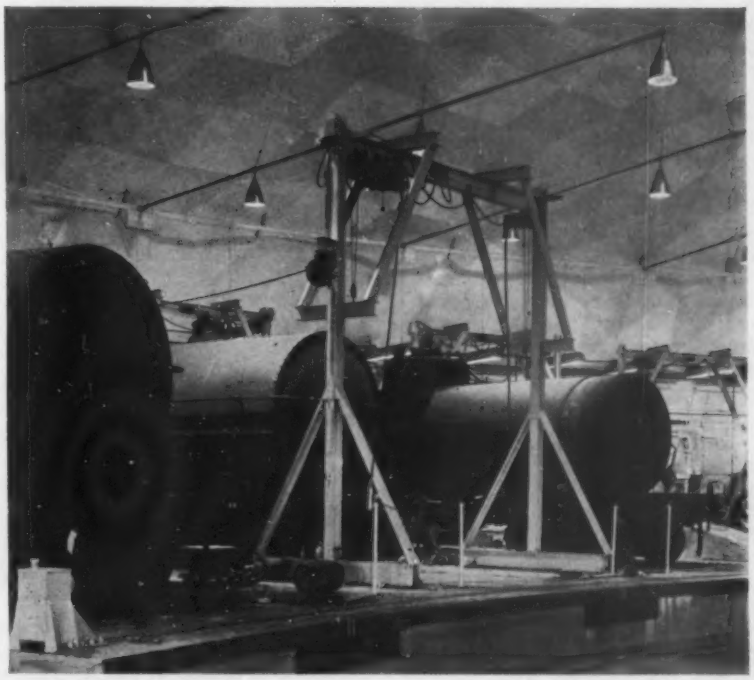
When Sachse Electric was awarded the contract on the proposed building in 1957, the company was immediately faced with many problems never before encountered in its long, successful career on major projects covering two continents.

It represented the first application in commercial history of a giant geodesic design, therefore Sachse as well as the general contractor, Nichols Construction Co., collaborated from the very beginning of preliminary site work. The electrical installation in fact was so new that the Sachse firm undertook the contract on a labor-and-materials basis because it was understood that neither the contractor nor the owners could possibly visualize all of the detailed problems that would develop as the structure took shape.

M. B. Sachse, president of the firm, stated that the building itself "was an entirely new concept of construction so practically all

(Continued on page 128)

Wiring for this circular dome building presented a number of problems, such as where to start! A transit was required to keep conduit placed according to specific reference points. Exterior of dome is lighted by a series of mercury vapor units such as the one shown here.



Principal illumination within the dome is provided by a great "wheel of light" 34 feet above work areas and aligned with railway tracks.

Higher levels, improved lamps

By Baron Creager

This article should be especially helpful to the following readers:

Electrical Contractors	✓
Electric Utilities	✓
Electrical Wholesalers	✓
Electrical Inspectors	✓
Industrial Engineers	
Consulting Engineers	✓

◆ WAYS AND MEANS of selling to the industry and to the public, new recommended levels of lighting, which are considerably higher than ever before advanced, were the principal concerns of delegates to the Southwestern Regional Conference of the Illuminating Engineering Society in Houston, Texas, recently.

In addition there were the usual technical discussions of the merits of various mediums of lighting and applications, by some of the best known authorities in the industry. Also, as is customary, it was a slide-conscious conference, with only two of a long parade of speakers failing to make use of highly illustrative slides, reproductions, or charts.

Further prestige was added to the conference through the presence of three national IES figures, the president and two top staff members. However, the conference began at the local level after opening remarks by John B. Deck, Jr., Southwestern regional vice-president.

Lighting contest

This local-level opening was the annual contest among chapter and section winners on the subject, "My Most Interesting Lighting Job." Contrary to previous patterns laid down by the program, this contest was first instead of last.

Session-Chairman Elmer L. Cole, Dallas Power and Light Co. and chairman, North Texas Section, turned the meeting over to Don Copeland, Crouse-Hinds Co., the contest chairman. For this event there was an imposing array of judges—George J. Taylor, national president of IES and vice-president in charge of research and development, Day-Brite Lighting, Inc.; Miss Myrtle Fahsbender, director of residential lighting for Westinghouse; W. S. Irving, Southwestern sales manager, large lamp division, GE; C. L. Crouch, IES technical director; John Neidhart, The Miller Co.; R. T. Dorsey, supervisor of commercial lighting, GE.

In the residential division of the MMILJ contest, there were three entrants.

Virginia Benson, home lighting advisor for Central Power and Light Co., in the coastal bend area of Texas, discussed with color slides, a residential lighting job on a rural home in the ranching area of George West, Texas.

Jack Huddleston, of the firm of Frey-Huddleston and Associates, architect and engineers of Shreveport, La., discussed the lighting of a completely circular residence of which, he said, there are no more than 18 in the world.

Third contestant, Mary Wallace, Texas Power and Light Co., told the audience she was completely awed by the jobs of the first two entrants and was tempted to withdraw, but did describe lighting of a speculative residence in Dallas so it would look attractive while empty and stimulate the buying impulse among prospects. For this she won first place, the judges decided, with Miss Benson second, and Huddleston third.

First of five contestants in the commercial division was Floyd Covington, City Public Service Board, San Antonio, who described lighting of a "horseshoe bend" in the San Antonio river as it wends through downtown San Antonio. He said there was much vandalism on the part of those strolling in this romantic setting and light sources were raised to a height of 30 feet.

Tom Lynn, Southwestern Public Service Co., Amarillo, described the lighting of seven blocks of the main Amarillo thoroughfare with color-corrected mercury luminaires.

Chairmen of the three sessions were, left to right: Elmer L. Cole, Dallas Power and Light Co., and chairman, North Texas Section; Richard W. Barnes, chairman of the Alamo Section and representative of Day-Brite Lighting, Inc.; M. H. Perkins, Southwestern Electric Power Co., and chairman of the Ark-La-Tex Chapter, Texarkana.

presented to IES conference

Don Copeland's subject was the manifold problems involved in lighting both exterior and interior of a paper manufacturing plant in Lufkin, Texas. Among these were exterior lighting for moving pulp logs which, Copeland said, have a factor of 99.9 absorption of light and the interior of a paper-machine, 600 feet long and 75 feet wide, with temperature 140 degrees and humidity 100 per cent, which must be entered for repairs when the paper breaks. Copeland was awarded first prize.

Re-lighting a church

Harold Samuels, Texas Power and Light Co., described the relighting of a church in Waco, Texas, where there had been 625 incandescent lamps with the result of too much brightness above and a lighting level too low at the floor.

The most interesting job for M. H. Perkins, Southwestern Electric Power Co., Texarkana, was the task of fitting a bank into an existing office building that was constructed in 1913 with much "gingerbread." He reported producing 90 footcandles for general banking, 105 at the teller booths and 110 at the check desks after nine months of operation.

Featured speaker following the general conference luncheon was President Taylor, who said that the "purpose of a regional conference like this one is to expand our knowledge of light." He said further that the IES function is to prepare technical information and use it for the external application of lighting.

Membership campaign

Mr. Taylor said there are about 9,000 IES members. Discussing the possibility of increasing membership "out of the 9,000 range," he said it would be wishful thinking to hope that each member would get a member.

"We get about 15 new members per 100," he continued, "but the trouble is that we lose about 13 per 100. I am asking you people here to really try to go out and get a member before October 1."

He discussed at some length the Blackwell researching and report, the RQQ committee's work, the matter of a higher level of footcandles, reflected glare, and the IES handbook.

(The Blackwell mentioned is Dr. H. R. Blackwell, formerly of the University of Michigan, now of Ohio State University Research Center. He is director of the Institute for Research and Vision and his IES connection is as director of the Illuminating Engineering Research Institute).

"I have a feeling we are not getting our information out to enough people," Taylor continued.

"We talk too much among ourselves. We have to understand it, obviously, before we put it out to other people. The scope of our information must be broadened far beyond what it has been.

"If we were only 20 per cent lighted under the old standards, how are we lighted under the new standards: Probably only a fraction of a per cent."

Accepting new standards

Asking: "How about acceptance of the new higher levels of illumination?" he cited improved results from improved lighting in four categories—a tool plant, retail store, office, streets.

"In 1906," he pointed out, "the cost of one footcandle of light was 7.7 per cent of a man's wages. Now, the cost of 200 footcandles is only 3.4 per cent of a man's wages.

"No longer, as a group of people, can we afford to gamble with the eyesight of men, women, and children. The only thing to do is to get our story of light and lighting to the public."

M. H. Perkins, Southwestern Electric Power Co., and chairman of the Ark-La-Tex Chapter, Texarkana, presided over the second session as chairman and introduced, as first speaker, Ted C. Sargent, assistant manager, Sylvania Commercial Engineering Department.

With the subject, "Light Sources and Their Applications," Sargent said he intended, for the most part,

Illuminating Engineering Society executives during coffee break at the Southwestern Regional Conference are, left to right: C. L. Crouch, technical director; George J. Taylor, national president and vice-president in charge of research and development for Day-Brite Lighting, Inc.; A. D. Hinckley, managing director of IES.

Convention committeemen and women of the host San Jacinto (Houston) Chapter pose here with the illuminated sign that welcomed visitors. They are from left to right George Simpson, Mrs. Merrill Wright, George McGonigle, Sumner Harris, Harry Hrivnatz, Wayne Toudouze, Mrs. C. A. Patterson, Bill Sneed, Richard Jung, C. A. Patterson, Don Copeland. Not in the picture is committeeman Arthur Rice.

to keep away from applications, although he might mention some for reference purposes.

"We cannot overlook the incandescent field," he warned, "for much of the glamour has not left that field although some are ready to write it off. Changes in incandescent as far as shape is concerned are self evident. The possibility of deviation from the rounded shape is, at least, upon us. But shape changes have more to do with promotion than with engineering. Color in incandescent will probably come as close to standardization as we shall see. It might seem that this industry of ours is more interested in making a profit than in technical progress.

Trends in Incandescence

"By comparison with others the incandescent lamp is shortlived, indeed. However, we can expect to see an extension of life of incandescent up to 5,000 hours. There is a new quartz type, very small, but very bright. Today there is a new trend in miniaturization of incandescents. By no means is the incandescent field dead or dull.

"In mercury, sizes seem to be reasonably well stabilized. The variety of development does not seem to be in sizes so much as in type and color. The white lamp of today is certainly the best performer. The electrode structure in mercury lamps is an advance in design, and we have electrodes today that are much more complicated.

"As for fluorescent, there was a time when you could say the fluorescent lamp had passed the mercury, but today we have to be careful about what we say. The No. 1 thing to be emphasized about fluorescent is the popularity of the rapid-start system. With the rapid start system, we may introduce variable loads which introduce flexibility."

Sargent performed a series of demonstrations, then continued:

"The advance in ratings will surprise you. We may be in the midst of the battle of the lumens. Don't be surprised if, in a few months, we have a fluorescent lamp of 80 lumens per watt.

"In the matter of electro luminescence, we will see for the first time this year the first practical application—and the first automobiles with the dash completely lighted by electro luminescence."

John Neidhart, previously identified, had the subject, "Quantity and Quality Requirements of Lighting." He perceived a challenge in view of "the opportunity we have with these new high illumination levels."

He emphasized that "when we talk quantity of the new higher levels, we also have to remember quality. There has been criticism of 'too much light' and we know that this criticism of 'too much light' has resulted from poor quality. We must avoid that criticism of 'too much light'."

Can we afford new levels?

He introduced a number of tables and charts by means of slides and continued, "Some argue, 'How can we afford these new high levels?' Actually, the 100 footcandle level costs no more than a 10-minute coffee break.

"Extra fine industrial seeing requires 1,000 compared with the previous 300 and extra fine cloth products seeing requires 2,000. Machine shops in some cases need up to 1,000. In some cases the level should be as much as five times what was formerly recommended. The annual owning and operating cost of a 200 footcandle operation represents about 2 per cent of the gross cost of operating the business."

He discussed the past practice of using maximum brightness for the measurement of glare and reported criticisms of the instrument used in measuring. He said, "you will see a lot more and hear a lot more" of one of our new recom-

mended practices and referred to the industry's "three-headed monster," explaining that reflected glare has three heads, but the monster can be eliminated by cutting off any one head.

"These three heads are," he continued, "the bright source, the shiny surface and the position of the eye to see the image." These he demonstrated with charts and, using one outdoor color photo, reminded his audience that outdoors under a shade tree the footcandles are 450 at table level.

"Illumination levels approximately double every ten years," he continued, "but the average of light falls far short of good practice. We are not doing a good selling job."

"Lighting Concepts Today and Tomorrow" was the program subject of R. T. Dorsey, supervisor of commercial lighting, GE Lamp Division.

"As lighting people we can no longer be satisfied to just do the engineering," he began. "Lighting must have a heart and a soul. We can't just draw a floor plan, we have to visualize what the room will look like. We need to visualize in three dimensions.

Lighting for the task

"Let's consider lighting for the task and seeability. We need to translate our language into words that the customer can understand. He doesn't realize the range for seeing today is 1 to 10,000. One way to translate it is to familiarize him with what our terms mean in light of his own experience.

"Average illumination today in commercial and industrial operations is 30 footcandles—we have installed some at 70—and we stand today at the next milestone. Some tasks are so difficult it might be better to make the task easier instead of raising the level of illumination. But, generally, as you increase the levels of illumination, conditions improve."

He said recommending anything less than the new levels is a disfavor to the customer, that the climate for progress in lighting was never better. He added:

"We are coming to control in fluorescent just as we came to control of incandescent. We are following the same pattern. We now control surfaces, and we face the prospect of getting as good control with fluorescent as we did with incandescent.

"Now is the time. We know what to do. We know how to do it. We can do it. We must say we will do it."

Richard W. Barnes, chairman of the Alamo Section and representative of Day-Brite Lighting, Inc., presided as chairman of the third session.

With the subject, "Flexibility—Today's Trend in Home Lighting," Miss Myrtle Fahsbender flavored her talk with spontaneous humor to the degree that she propelled recurrent ripples of titters, if not outright laughter, through the conference. She is director of residential lighting for Westinghouse.

Smaller light sources

"Light sources are getting smaller," she declared at the outset, "and so create a bit of a problem for the fixture designer. But to live is to change and change is to live and you might think that over. Some day we will probably have a whole wall of luminous light source."

Holding up a small, square, plug-in device she later identified as a new night light, she said of it:

"In a couple of weeks you will have this electro luminescent plug-in which sheds a soft, green light and when you get up in the wee hours of the morning—that was a bad choice of words, wasn't it? Well, when you get up in the wee hours to go to the nursery—that cleans it up — you will have the help of this plug-in device that will last for 1,000 hours.

"We can all remember when a fixture program for a house meant a few fixtures. The fixtures practically went out but, due to architecture, they are back, but we don't use them like we used to." Using slides she pointed out:

"The parlor is coming back in the American home. There is a return to refined living. Women now want dining rooms and the trend is away from the combined living-dining area. It is better for the children to have a dining room. If the children eat in the kitchen they have kitchen manners."

Using a color demonstrator for fluorescent, she showed how the choice of one wrong fluorescent tube can ruin the color scheme of a home. She said: "With this (demonstrator) I can show the customer why she doesn't like daylight and cool, which the distributor usually carries."

Garden lighting

Referring to garden lighting, Miss Fahsbender declared:

"We haven't scratched the surface. We don't know how to sell it. People say it costs so much and I'm sick of hearing that when they spend $2,000 on one bath room.

"I wonder if you," she said, ad-

(Continued on page 125)

M. H. Perkins, of Texarkana, chairman of the Ark-La-Tex Chapter received for his chapter the attendance award created this year by the Ark-La-Tex Chapter in memory of Reuben Lothrop. Making the presentation is Regional Vice-President John B. Deck, Jr.

Logical route to wiring profits

By Beatrice Miller

This article should be especially helpful to the following readers:

Electrical Contractors ✔
Electrical Utilities
Electrical Wholesalers ✔
Electrical Inspectors
Industrial Engineers
Consulting Engineers

◆ WITHIN SIX MONTHS after occupying a new location, A/C Electric Company, Inc., Washington, D. C., upped volume in commercial, industrial, and residential wiring by 40 per cent.

President Milton L. Klein attributes the gain to time and step-saving procedures which have created a highly efficient organization.

Approaching his operation with a view to improving efficiency, this contractor is constantly re-designing job forms, rearranging warehouse layout, and ever seeking new methods to attract and *keep* customers through prompt, efficient service and fair prices.

Close margin operation

"I am satisfied with a small margin of profit," Klein commented. "Working on close margins I can build up a larger volume. I estimate on a cost-plus basis. When a customer gets a competent job at a fair price, he believes in the honesty of A/C. Knowing he will get value for his money, he will come back, time and again, and tell his friends and neighbors about us," said Klein, indicating that 50% of his volume was commercial, 25% industrial, and 25% residential.

Klein continued:

"The great advantage of customer confidence to a company is that your customer will not require you to make an estimate on every job he wants you to do. From previous experience and personal contact he has had with you, he knows he will get a fair and honest price on a job. This saves your time in running out for estimates. In fact, it means a sizeable savings if you've

(Continued on page 126)

"A place for everything, with everything in its place" may well be the motto of A/C Electric's Milton Klein, who, above, quickly checks the availability of a specified electrical item, his search simplified by use of small storage bins in which all small items are kept.

The more trucks you have, the better service you can give, in this firm's opinion. Each truck is daily assigned to one electrician.

Flexible lighting for an office building

By W. M. Massey

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers ✓

◆FUNCTIONAL BEAUTY is the keynote of the lighting for the new eight-story annex to the general office of Alabama Power Company, Sixth Avenue and 18th St., Birmingham, Ala.

This office building is one of the largest commercial lighting jobs for the Birmingham area in the past decade or so, and in the field of lighting for office buildings it is one of the best examples of advanced lighting and wiring practice.

The lighting, designed by the architects Van Keuren, Davis & Co., is in harmony with the colorful Porcel-Panels forming the aluminum skin of the outside walls and with the movable partitions that provide maximum freedom in the arrangement of interior work space on all eight floors. Future maintenance estimates were also carefully considered.

The Pittsburgh recessed fluorescent fixtures that make up the troffer lighting are supported on the same aluminum T-bars that also support the ceiling. All corridors, store rooms, and rest rooms have incandescent recessed fixtures.

In total illumination equipment this office building is considered to have set a new high for the state. Records of the electric contractor, the Canterbury Electric Co., Birmingham, show a total of 2,700 two-tube flourescent fixtures requiring 22,000 pounds of glass, and a total of 500 incandescent fixtures.

In fitting the lighting design to the service intended, the firm of Hazard, McRoy & Cone, consulting

(Continued on page 125)

Typical work area is shown here. Troughs of fluorescents provide 75 footcandles at work level. On right is shown one of the movable partitions used to separate the various offices and work areas.

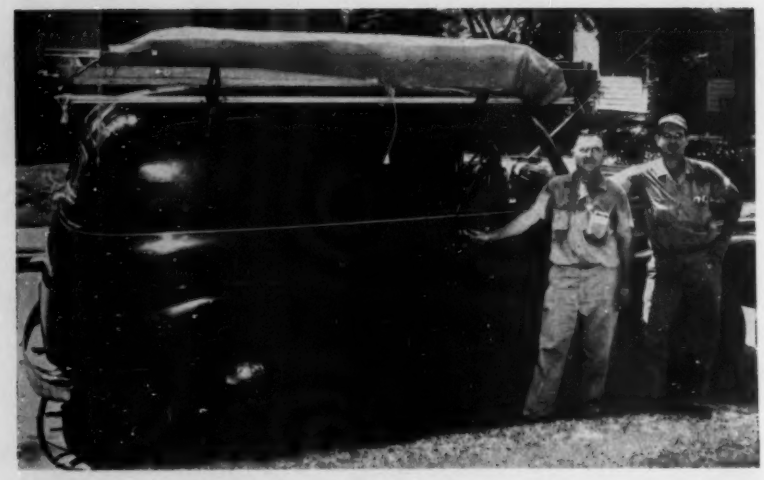
Construction details on installing fluorescent troffer fixtures under poured concrete. Conduits fastened direct to concrete by shooting. Ceiling, suspended to allow for heating and cooling ducts, allowed ample space for installing troffers.

Contractors tell how

Three rules retain customers and cultivate new business

By Carl Habig

Habig Electric Contractor
Little Rock, Ark.



Carl Habig and his son, Carl, Jr., arrive on the job at the time promised. This is the company's first rule for retaining customers.

A canvas drop cloth is spread on the floor where the electrician works. He always takes a broom and dust pan to clean up every trace of litter.

◆ REPEAT residential business is worth cultivating in this era of electrical living. Knowing that a customer who has confidence in me will call my telephone number again within a year or two, I have set up a few rules designed to hold my customers permanently.

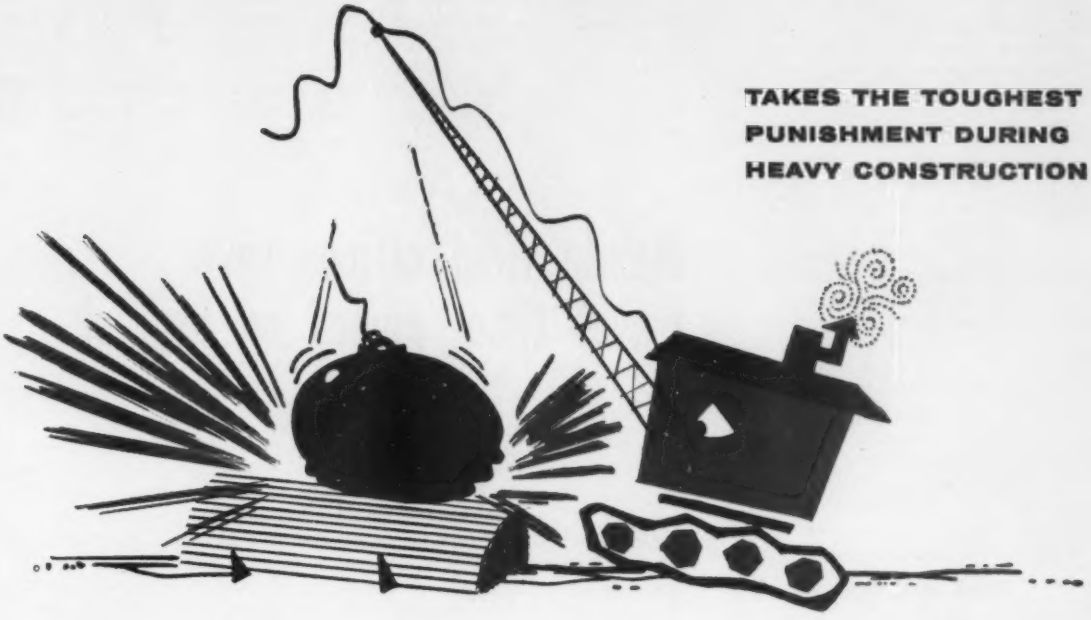
Residential repairs and remodeling call for direct contacts with women customers, and for these especially are my three rules planned for repeat business. They are promptness, neatness, and guaranteed work. They sound simple, but behind each one of these rules is a plan to impress the customer.

First, promptness

Consider the first, promptness. When a customer calls in, she is told that the electrician will see her within two hours. Most women dislike to be bound indefinitely to be on hand to receive repair service of any kind. Some of my customers, impressed with my fast, definitely stated service, have told me that formerly they had waited for many hours or even days in order to be on hand when the electrician called. If I cannot give service within two or three hours, and if the job is not an emergency, I try to specify, within an hour or so, when the customer can receive service. This rule has helped me to build a reputation for prompt service that influences repeat business.

Second, neatness

Women value neat repair work. They usually know little or nothing about checking wiring, but they do notice whether or not the electrician leaves the premises in order. We always spread a canvas drop cloth on the floor where we work. A dust pan and brush go into the house along with our tools. After the job is done, the brush and pan collect every trace of lit-



TAKES THE TOUGHEST PUNISHMENT DURING HEAVY CONSTRUCTION

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STEEL

CONDUIT IS BETTER

1 Greater inherent and structural strength
2 No special exterior preparation needed for concrete installations
3 Takes toughest punishments during construction
4 Uses standard tools and accessories
5 Easier to fish with a tape
6 Compatible with all building materials
7 Great resistance to corrosion and alkali reaction
8 Greater protection of conductors after installation
9 Immediate delivery from distributors and mills
10 Proven for more than a half a century in millions of installations

CLAYTON MARK, pioneer in electrical conduit since 1910, specializes in producing steel conduit that meets all building specifications. Our facilities, engineering and production know-how guarantee quality products accepted as "The Contractors' Favorites" in the industry—Electrictube, Hotkote, Galvakote and Enamelkote.

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ter left by work done. This showmanship we use with the drop cloth and the dust pan, which we contrive to make the customer notice, has caused more comment than the quality work we try to produce. Some of our customers, having experienced our self-promoted neatness, have even given us a key to the house to do a job for them while they were on vacation.

Carrying neatness a step farther, we apply it when we have to rip off a piece of siding, frequently necessary when wiring for air conditioning or for a convenience outlet placed on an outside wall. Replacing the board, we countersink nail holes, and even apply a little putty and paint when needed.

A contractor making repairs or modernizing the wiring in an old house never knows what he is going to find in old walls. If he is not careful, he will cause a lot of cleaning for the housewife. Leaving a room as clean as we find it is good advertising for us.

Third, a guarantee

Guaranteeing all work we do for one year is the third rule that helps us to hold customers for repeat jobs. All of our advertising states that we guarantee our work. Electrical repairs seldom go wrong. A year's guarantee actually means little. But women, knowing little about electrical wiring, value a guarantee. When we finish even a small job, we remind the customer that we stand behind our work with that year's guarantee.

Follow-up by manufacturers' agents helpful

By Leonard H. Harkness
Engineer and Estimator
Hitt's Electrical Service, Inc.
Rockville, Md.

◆ ONE OF THE BIGGEST helps to legitimate estimating would be a follow-up by manufacturers' representatives who had sold architects and consulting engineers on specific materials to learn whether orders were placed for those materials. It would provide reassurance on a job that no substitute had been used.

In these times of heightened competition a follow-up of this kind would be a means of eliminating a substitute material and providing the job with the quality of materials contracted for. An architect's office inspecting a job during construction does not always recognize when substitutions of materials have been made. Such a follow-up procedure would be of benefit to the architect specifying the material, to the contractor who prepared the estimate on the material specified, and to the building owner who should get the materials specified and paid for.

Mobile field offices save travel time, money on big jobs

By V. G. Armstrong
Owner
Acme Electric Co.
Knoxville, Tenn.

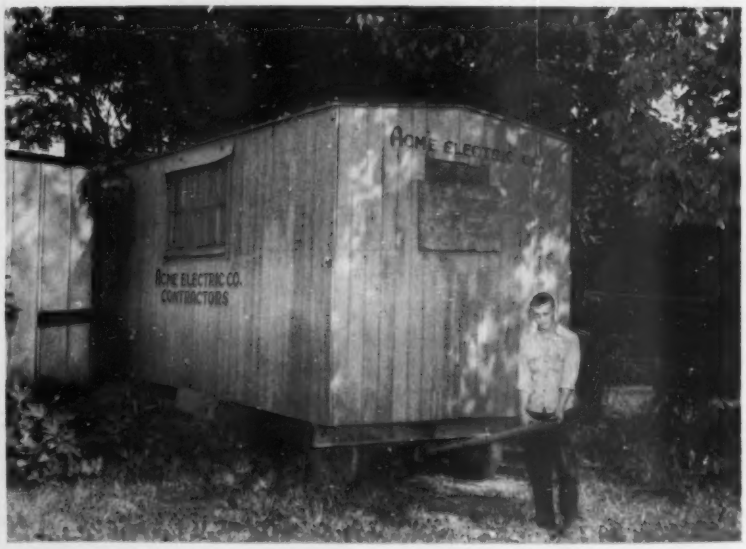
◆WE SAVE at least $150 on every electrical contracting job with our new mobile field offices. We have four such offices that we can move around easily and which we make ourselves. We got the idea from a general contractor who sold us an office, and we made the other three.

The offices have wooden frames that we build on the chassis of an old automobile. One truck can pull the office to the site of an electrical job. We just hitch the office to the truck and take it wherever we want to go.

Our new system saves a lot of time—the time it takes for men to come in to our main office and shops in Knoxville and then go back to a job 25 or 30 miles away. Under the old plan, two or three hours a day would be lost. With the new system, the men can go right to the field office, and we can get in a full eight-hour day.

We use the field offices only on big commercials jobs. On small jobs in Knoxville, we do not need them. We always have a foreman on the job to keep the office until the job is complete.

Each field office is equipped with tools necessary for the job.



This is one of the mobile field offices made by Acme Electric Co., Knoxville, for use on larger jobs. It can be pulled to the job by a truck and can be moved around, as needed, at the job by one or more workers.

A safe, long-lasting wiring system is a must for Colonial Williamsburg's Motor House and Cafeteria to safeguard valuable equipment and eliminate future costly repairs. For these reasons, the specifications called for the finest quality conduit. The choice . . . SPANG HD Galvanized Steel Conduit.

22 miles of SPANG Conduit give modern wiring protection for new buildings in "Colonial Williamsburg"

The magnificent restoration of Colonial Williamsburg turns back the clock 200 years. But The Motor House and Cafeteria, nearby, must be equipped to accommodate in 20th Century comfort their share of the 750,000 visitors each year.

22 MILES OF SPANG HD!

Helping in this task are 22 miles of SPANG HD Galvanized Steel Conduit, which carry the up-to-date wiring. Operated by this extensive system, which is designed for future expansion, are the all-electric kitchen, three 250 hp boilers, and the complete air conditioning system.

QUALITY IS THE KEY NOTE

In specifying materials, the question was not, "How much will it cost?" but rather, "How well will it serve?" SPANG Conduit was selected, because it met this requirement—by giving the maximum in performance and insuring the minimum in future "down-time."

YOU ALWAYS GET QUALITY WITH SPANG

If your wiring contracts require *top-quality* conduit, you'll get reliable installations with *quality-controlled* SPANG Steel Conduit. And your local SPANG Distributor will give you the good service you need.

Architect: Colonial Williamsburg Architect's Office; consultant: Harrison & Ambrovitz, New York
Electrical Engineer: Wiley & Wilson, Richmond, Va.
Electrical Contractor: Chewning & Wilmer, Inc., Richmond, Va.
SPANG Distributor: General Electric Supply Co., Richmond, Va.

SPANG CONDUIT

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

An electric pipe threading machine serves also as a wire puller and as electric hoist in an emergency. Using it as a wire puller, two men can do the work of four.

We charge these tools to the foreman on the job, and when that job is finished, we credit him for the tools returned. This way we keep up with tools and materials and know what we have. In our office where everyone can see there is a sign reading: "Absolutely No Tools Loaned."

A lot of our materials which we order for a job are delivered directly to the field office from the distributing point. Often we never see the materials at the main office in the city. A safe storage place for blueprints is also provided in the field office.

The field offices are wired for lights, telephone, and a heater for use in the winter. The boys can go there for hot coffee and a warm place to eat their lunch. The office is for their benefit, too. We have a meter right on the mobile office building. We can either tie in on the project lighting or have a temporary meter cut in.

Three or four men can push the field office on wheels when it has to be moved at the job site. We do not need a truck to move it short distances. On a construction job, I have seen other field offices which were in the way and had to be moved with a great deal of trouble. There is nothing to moving one of ours.

Permanent use

Some contractors spend $150 to $200 for a temporary shack which has to be torn down and set up again. One of our field offices costs $500 to $600 by the time we get through making it, but we are through then and have something we can keep for permanent use.

We have some other ideas on the job which help us, too. There is the electric pipe machine, for instance, which we take along with the field office. It is used to cut and thread pipe on the job as the installation goes along.

We use the machine for an electric wire puller, too, and find that two men can do the amount of work that it ordinarily takes four to do in pulling wire. The pipe machine can also be used for an electric lift — in lifting heavy equipment up on a wall or high ceiling.

The little jobs can add up— if you carry them

By George Corbett
Corbett Electric
Bradenton, Fla.

◆ IT IS a basic economic principle that "the charge customer is your best customer—if he pays." The charge customer is obligated to do business with his creditor, whereas the cash customer is anybody's customer and will take his business anywhere.

That is the way we have found it, and that is the reason we encourage small wiring jobs and carry the accounts ourselves, on a time-payment basis that nets us business which we or any other contractor, might never otherwise get to do.

For example, few if any lending institutions would finance the small jobs we get. In many of these jobs, if the customer had to pay cash upon their completion, they simply would not get the job done at all.

An apartment house owner, or the owner of an antiquated home whose wiring was installed back when they passed Ohm's Law, might very well understand that the wiring system is in desperate need of a revamping. His financial status, however, may be such that he cannot undertake the burden, except on an installment-plan basis. While we can make him aware of the inadequacy and the potential hazard of his overloaded wiring system, he will struggle right along with it, if he has to pay cash upon completion of the needed recircuiting.

By financing the job ourselves, we do the customer a favor, and we do ourselves one. In our case, we know we will get paid, and there is little in our experience or bookkeeping records to indicate otherwise.

Little competition

Again, we get full list price for our work, for there is comparatively little competition for the contracting crumbs to be garnered among the low income or financially-harassed folks who need financing and in this fertile field we have found among small home owners.

When we point out the dangers of an antiquated wiring system to such people, or the risks faced by tenants and owner of a "flea-bag" tenement house, and then follow this up with an offer to do the rewiring on a basis well within the ability of a debt-burdened customer to pay, we land the job, and his undying gratitude.

When a customer has paid us in full, we call our local credit bureau and notify them of the fact, which helps the customer in his later attempts to establish credit at area stores for other purchases he may need. This puts us further into the customer's good graces.

We number among our customers some so illiterate that my wife has to go around and help them make out a money order for their payments.

In addition to these folks, we get people whose credit is good and will be accepted as good credit risks by a finance company. Since we figure if such a person is a good risk for the company, he is a good prospect for us, we point out that our carrying charges are much less. This, plus the fact the customer would rather pay the contractor who did the work than the finance company, on the presumption that when trouble develops he has our ear for his complaint, we invariably land the job.

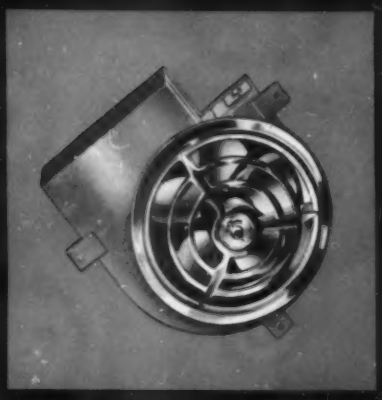
Promoting adequate wiring

Furthermore, because we are ready to help with the financing,

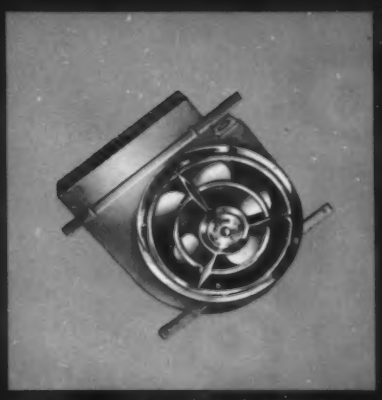
(Continued on page 127)

You name it - NuTone has it

12 BASIC NUTONE EXHAUST FANS*
FOR YOUR KITCHENS & BATHROOMS



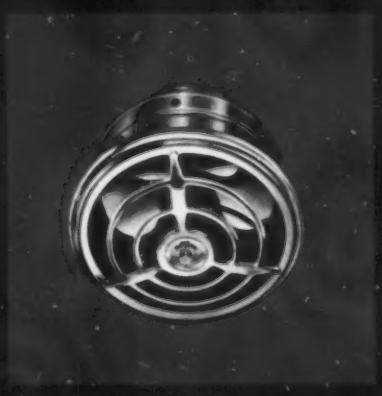
Model 851-N for Ceiling or Wall. Snap-In motor and fan assembly.



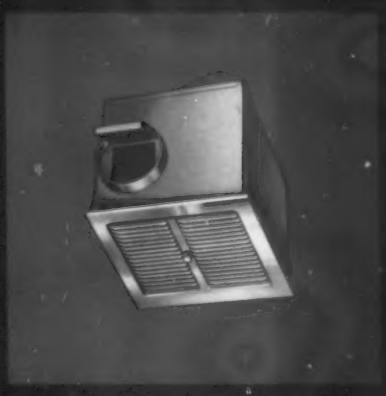
Model 831-N. Powerful 8-inch fan for use in Ceiling or Inside Wall.

Model 870 Twin Blower. for installation in cabinet, wall, ceiling.

Model 820-NJF. Jet-Flo Fan for Vertical Discharge through roof cap.

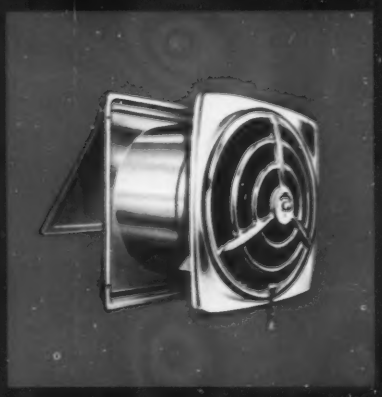


Model 848. Powerful Vertical Discharge 10" fan. Snap-in Fan assembly.

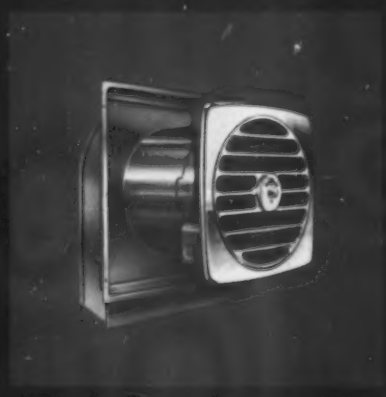


Model 881 Bathroom Fan. A blower type fan with a high static pull.

Model 801. 8" Pull chain type for Wall. with weather-tight shutter.



Model 811 Deluxe 10" pull-chain Wall Fan. Weather-tight shutter.



Model 807 Automatic Wall Fan. Patented flutter-proof shutter.

* Illustrated here are 9 of 12 basic models . . . America's most complete line of Exhaust Fans

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NuTone Quality Costs You No More!

FEATURES LIKE THESE MAKE NUTONE YOUR BEST BUY!

NuTone

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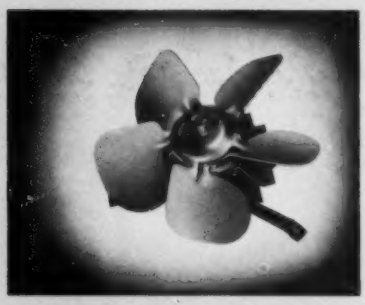
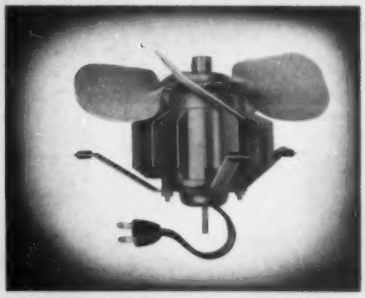
MODEL #851-N (FOR CEILING OR WALL) IS A TYPICAL EXAMPLE OF THE MANY OUTSTANDING FEATURES FOUND IN EVERY NUTONE EXHAUST FAN

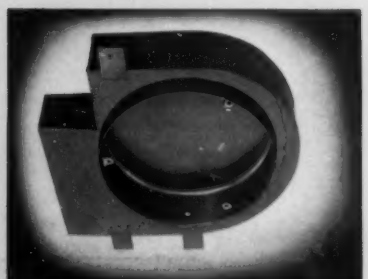


Specially designed fan blades . . . plus a powerful 1/20 HP motor for higher air delivery.

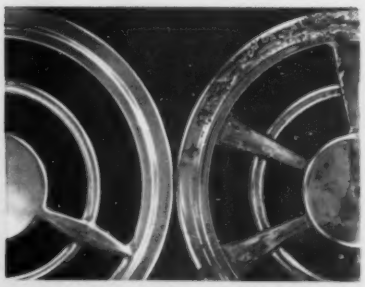


Closed motor prevents grease from clogging windings. Extended fins keep motor cool.

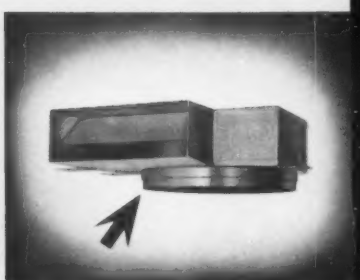
Automatic safety grounding strap. Approved by UL & CSA. Avoids shock and fire hazards.



Venturi Housing . . prevents air back-lashing. This produces higher "Static Pressure Push".



NuTone Anodized Grille (left) will not corrode like the ordinary chrome grille (on right).



Adjustable sleeve insert . . . for different plaster thickness . . . hides rough cutouts.

← SEE OTHER SIDE

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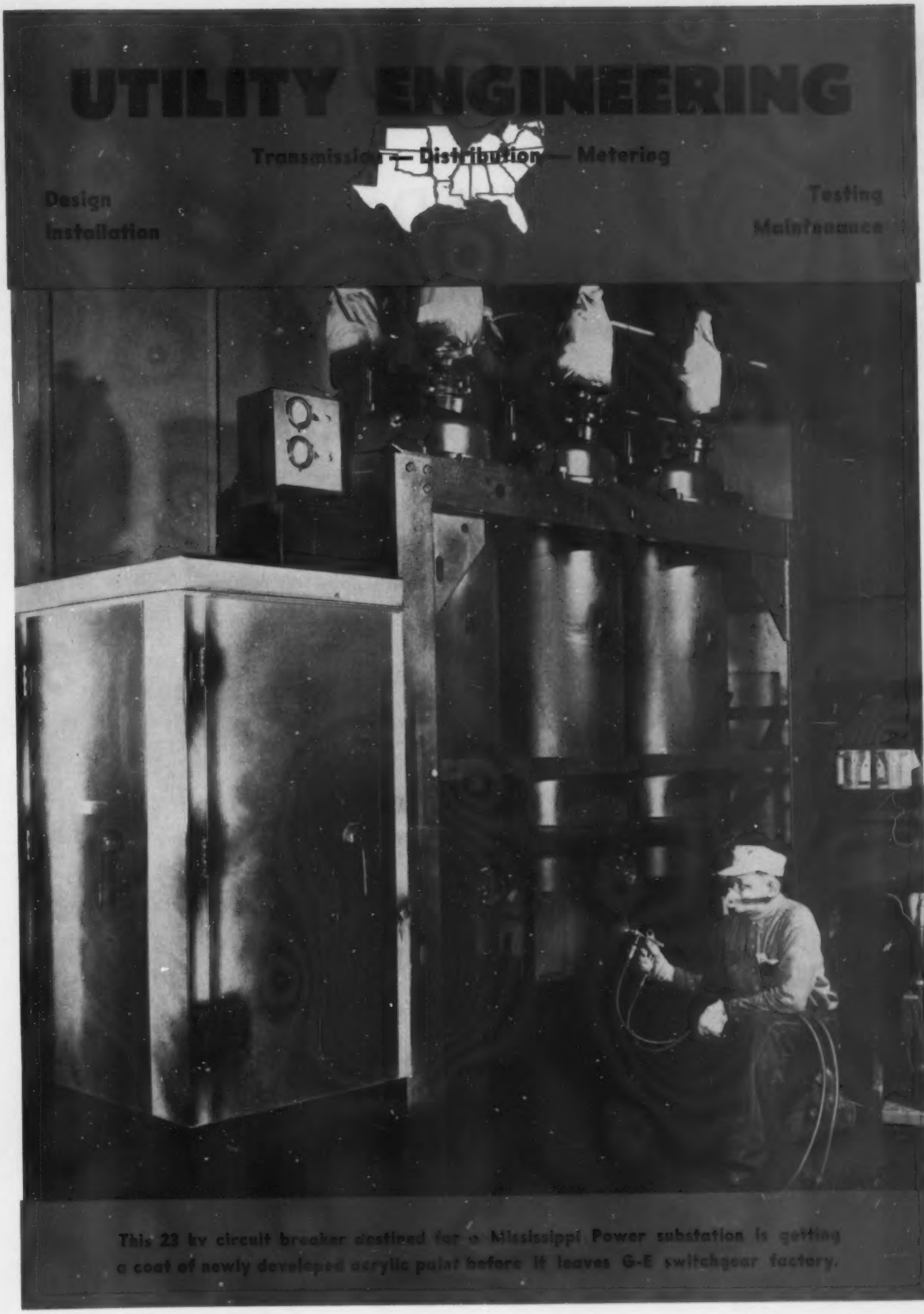

This 23 kv circuit breaker destined for a Mississippi Power substation is getting a coat of newly developed acrylic paint before it leaves G-E switchgear factory.

Let's take a closer look at Demand Metering . . .

Why Call it Demand?

Does the word "demand" make you bristle?

While we all know that demand charges are fully justified from the standpoint of basic economics, the electric power customer often fails to realize that it is he who is making demands on the utility rather than the other way around. If psychology has a place in rate-making, should the word "demand" have ever been admitted to the electric utility vocabulary?

Today, when demand metering is being applied to the measurement of more and more residential loads, seems to be a good time to reconsider our use of the word. Electric customers, tabbed with a *demand* charge on their electric bills, have a tendency to bristle at the term.

If we remove *demand* from demand metering, it becomes a more acceptable concept . . . and if we substitute a logical and less offensive word in its place such as load, peak, or power, we have a more readily understood term.

What's your suggestion? We would like to hear from you. Address Glenn M. DeKraker, Sangamo Electric Company, Springfield, Illinois.

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Sangamo offers the most complete line of demand measuring devices in the industry —equipment to indicate and record demands from the smallest values to the largest encountered by the electric power industry. The line includes singlephase and polyphase mechanical demand registers, thermal demand meters, indicating and graphic meters, digital demand recorders and translating systems for Kw, Kvar, and Kva demand. You can look to Sangamo for all types of demand devices.

*Until you change the term "demand".

JH59-3

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Sangamo's new Type D mechanical demand register, when installed on any of the Sangamo extended range J2 and P2 watthour meters, gives the most accurate indicating demand measurement available. You get 1% full scale accuracy.

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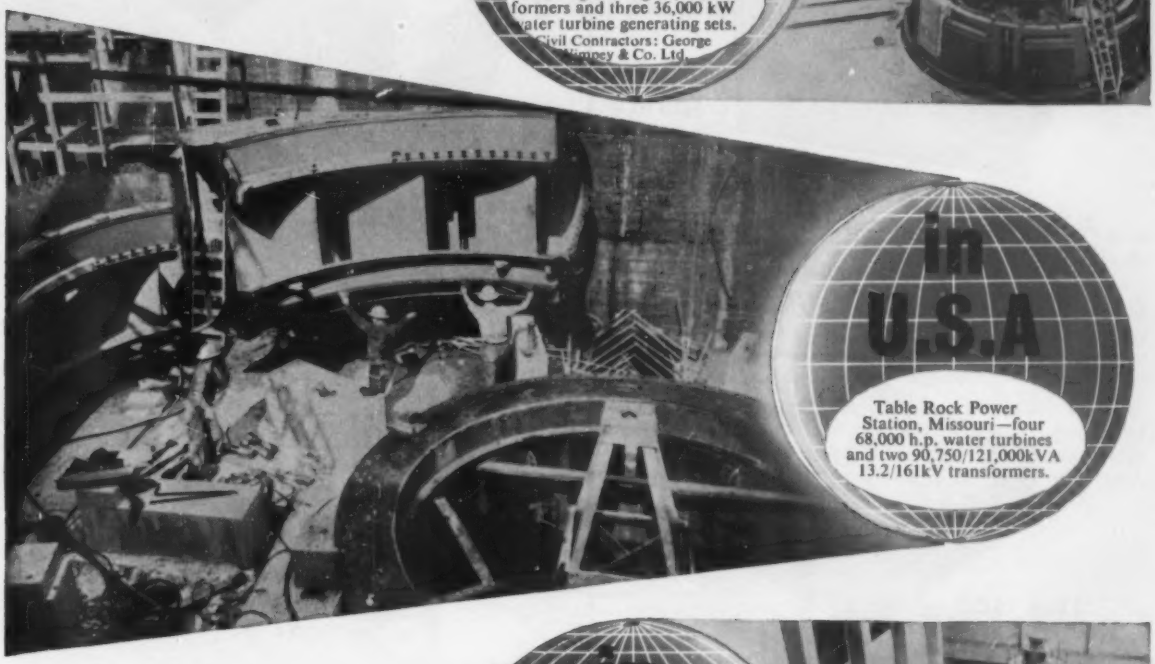

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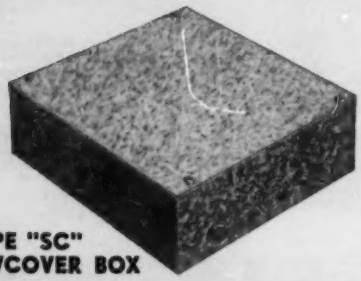

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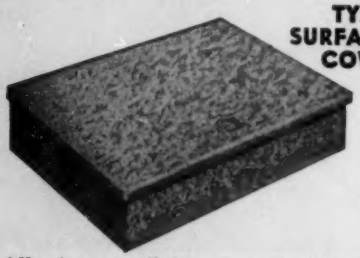

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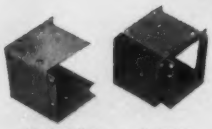

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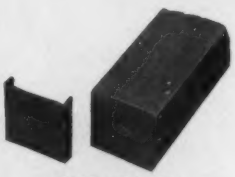
"U" CONNECTOR



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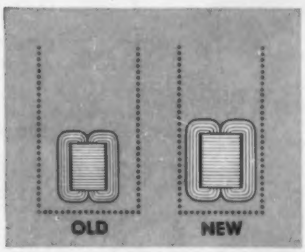
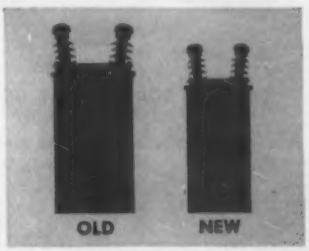
This distinctive Kuhlman transformer, with its gleaming gold color, spells prestige for the utility, for the builder and developer of the all-electric neighborhood, and for the people who live in the Medallion Homes the transformer serves.

Kuhlman "Perma-Gold" Transformer, available in conventional or CSP pole-type ratings, is a symbol of the great achievements of the electrical industry, and a symbol of Kuhlman's own achievements in transformer design and efficiency.



BIGGER INSIDE

New design allows Kuhlman to build a larger core and coil, using more copper and steel. This provides improved impedance, lower losses, and better regulation.



SMALLER OUTSIDE

Shorter, slimmer tank takes up less room on the pole. Small size offsets increased weight of stepped-up core and coil.

Ask your Kuhlman representative to give you all the facts about how the Kuhlman "Perma-Gold" Transformer will build the prestige of your all-electric communities.

KUHLMAN ELECTRIC COMPANY
65th year
the year you get more for your transformer dollars

KUHLMAN TRANSFORMERS

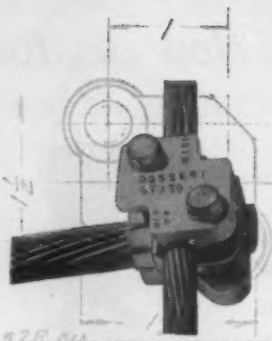
KUHLMAN ELECTRIC COMPANY, Birmingham, Michigan

Manufacturers of transformers since 1894

Southern Division: CRYSTAL SPRINGS, MISSISSIPPI

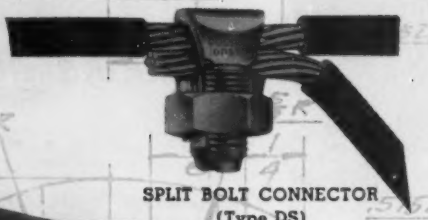
DOSSERT DESIGNED

with YOU in mind!



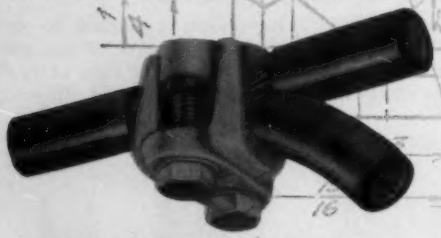
TWO POSITION VARIABLE TAP
(Type GTX)
For cross, parallel and tee tap connections.

LIGHT DUTY VARIABLE LUG
(Type G)
For economical, all-purpose cable connections.



SPLIT BOLT CONNECTOR
(Type DS)
For taps, dead-ends, entrances, motor leads, junction boxes, etc.

VARIABLE TERMINAL
(Type D)
Connects a wide range of copper conductors to flat bar.



TWO BOLT SERVICE CONNECTOR
(Type DSU)
For all service cable connections. Best for larger sizes.

For YOU, the contractor...
For YOU, the wholesaler...

The products shown here are in constant demand by contractors and are fast moving stock items. All items accept a wide range of cables, thereby, minimizing the number of stock sizes. They are packaged in convenient quantities for ease of handling and are attractively labeled for quick identification.

HEAVY DUTY VARIABLE LUG
(Type HL)
Takes various conductor sizes. Quickly installed.

Ask for pocket catalog, giving name of your distributor.

50 YEARS OF TECHNICAL KNOW HOW

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Representatives in principal cities.

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INTERNATIONAL GENERAL ELECTRIC COMPANY
Construction Materials and Lighting Sales
150 East 42nd Street,
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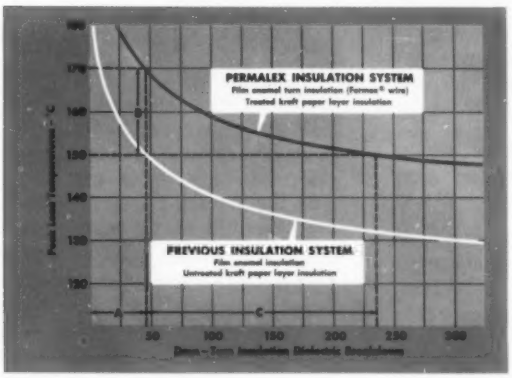
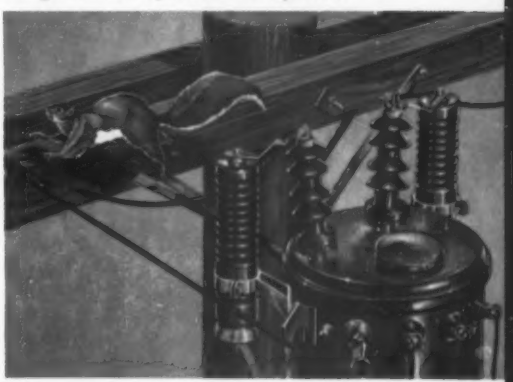
GENERAL ELECTRIC ANNOUNCES . . .

NEW 1959 Distribution Transformer

NEW Permalex* insulation permits 20% additional load with full transformer life.



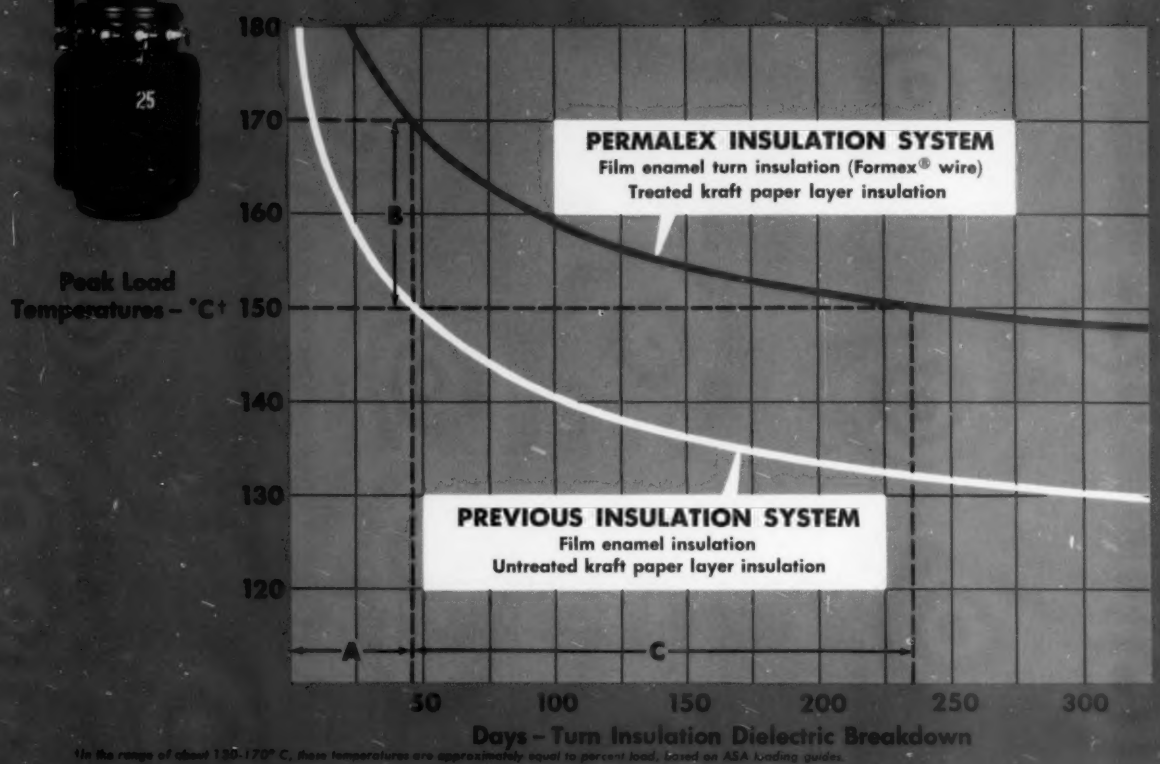
NEW Melalast* finish prevents service outages caused by birds and squirrels.



*Trademark of General Electric Company

GENERAL ELECTRIC

NEW 1959 GENERAL ELECTRIC DISTRIBUTION TRANSFORMER



NEW 1959 G-E DISTRIBUTION TRANSFORMERS, with Permalex insulation, provide utilities important savings in operating costs. For example, A shows life of former transformer at 150% of rated load. B shows how Permalex insulation increases loadability 20% with same life. C shows increased life—almost 400%—at present loads with new General Electric Permalex insulation system.

PERMALEX

Insulation Gives G-E Transformers Exclusive 20% Added Loadability with Full Transformer Life

Standard on the new 1959 General Electric pole-type distribution transformer, Permalex insulation brings electric utilities important savings in operating costs. You can get increased transformer loadability, or increased transformer life, or a combination of both. The new transformer will be available through 167 kva.

Users can increase transformer loading an additional 20% of nameplate rating and still get full transformer life — thanks to the increased loadability permitted by Permalex, the new General Electric insulation system.

Utilities who normally remove transformers, or add units, when peak load on the transformer reaches 150% of rating, for example, can now load to 170% and obtain the same long transformer life as before. Or you can utilize increased thermal stability to get 400% longer life with present load, or a combination of both increased life and load.

WHY PERMALEX GIVES EXTRA STRENGTH

The new Permalex insulation system uses a cyanoethylated kraft insulation material, patented by G.E., to preserve high dielectric strength. Cyanoethylation of the kraft retards formation of moisture, released by cellulosic materials when subjected to load.

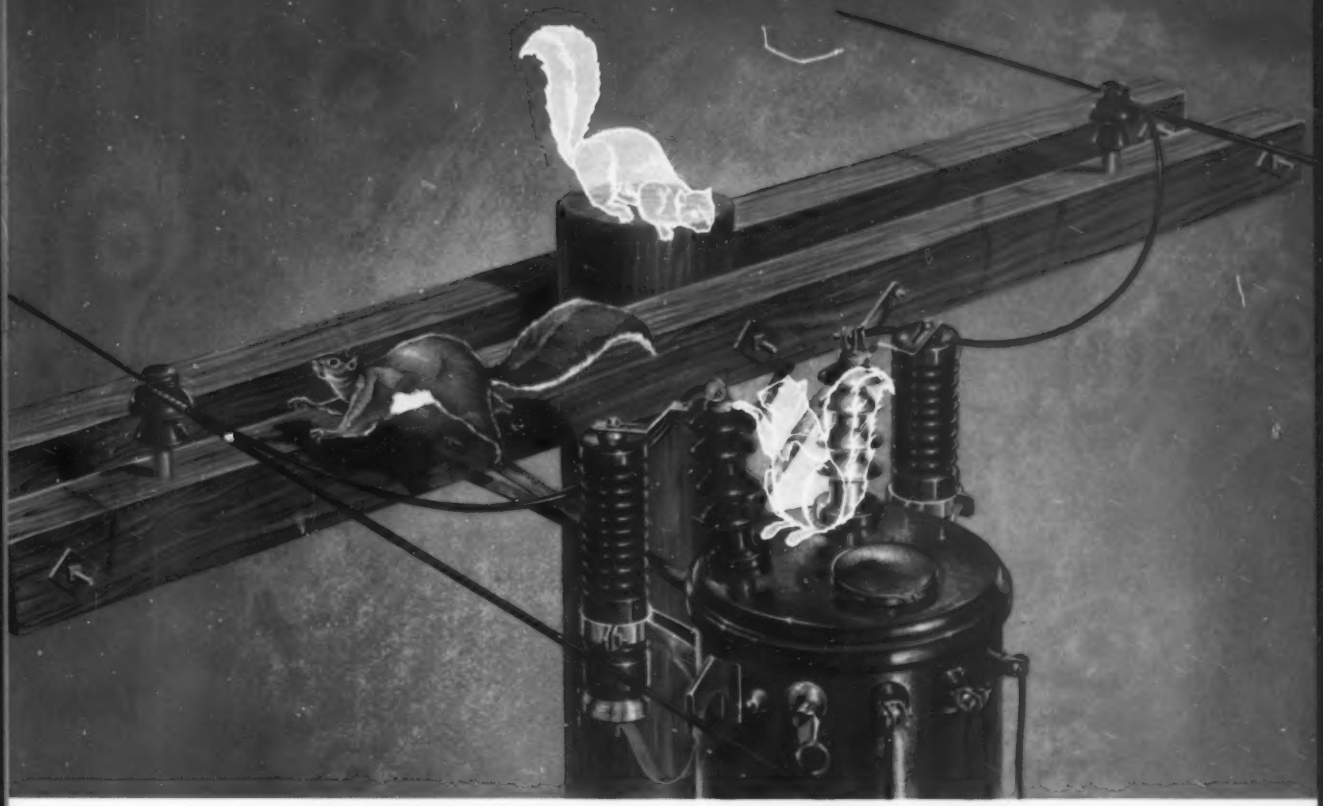
In the Permalex insulation system, cellulosic materials are treated in raw pulp stage to replace "OH" chemical groups with "Cyanoethyl" groups. Since this retards water formation, the new G-E transformer withstands better the higher temperatures which accelerate aging of insulations not treated by the cyanoethylation process.

PERMALEX IS COMPATIBLE

Permalex is completely compatible with everything in the transformer, is clean, safe and odorless. It has no detrimental effect on components such as enamel film insulation, steel or aluminum parts, or oil.

The new 1959 General Electric distribution transformers with exclusive Permalex insulation will be available at no price premium.

REDUCES UTILITY OPERATING AND MAINTENANCE COSTS



MELALAST FINISH ON COVERS of new G-E distribution transformers prevents outages caused by birds and squirrels, eliminates need for special "bird guards" or terminal taping. Slight shock sends visitors safely on their way, as shown in the artist's conception above.

MELALAST

Finish on Cover Prevents Outages Caused by Squirrels and Birds

New savings in installation and maintenance expenses are now possible with Melalast finish on covers of General Electric pole-type distribution transformers. This cost-saving feature is provided at no price premium on all ratings above 5 kv.

Melalast finish is a modified epoxy resin which insulates birds and squirrels from the grounded cover, thus preventing outages and customer complaints. It is applied to both main and handhole covers and cover bands.

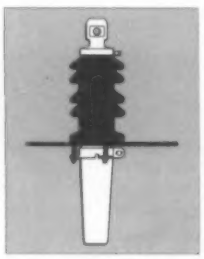
The Melalast coating protects from line to ground but still provides a slight shock, sending squirrels and birds safely on their way. Melalast finish also provides improved corrosion resistance.

Melalast finish, from the G-E Pittsfield laboratories, is another added value benefit which utilities derive from General Electric research and development.

GENERAL ELECTRIC

OTHER ADDED VALUE BENEFITS OF NEW G-E DISTRIBUTION TRANSFORMER

NEW BUSHING on the 1959 General Electric distribution transformer permits replacement of high-voltage fuse without removing the bushing. This helps reduce maintenance costs. In addition, positive method of internal clamping eliminates external parts, potential sources of corrosion.



NEW ROLLED-UNDER BASE on G-E distribution transformers through 100 kva reduces maintenance costs by minimizing finish damage from scraping. Minimizes floor and truck-bed scuffing.

NEW LIGHT AND BREAKER SETTINGS make usable the extra loadability possible with Permalex insulation. Graphs and further details on following page.

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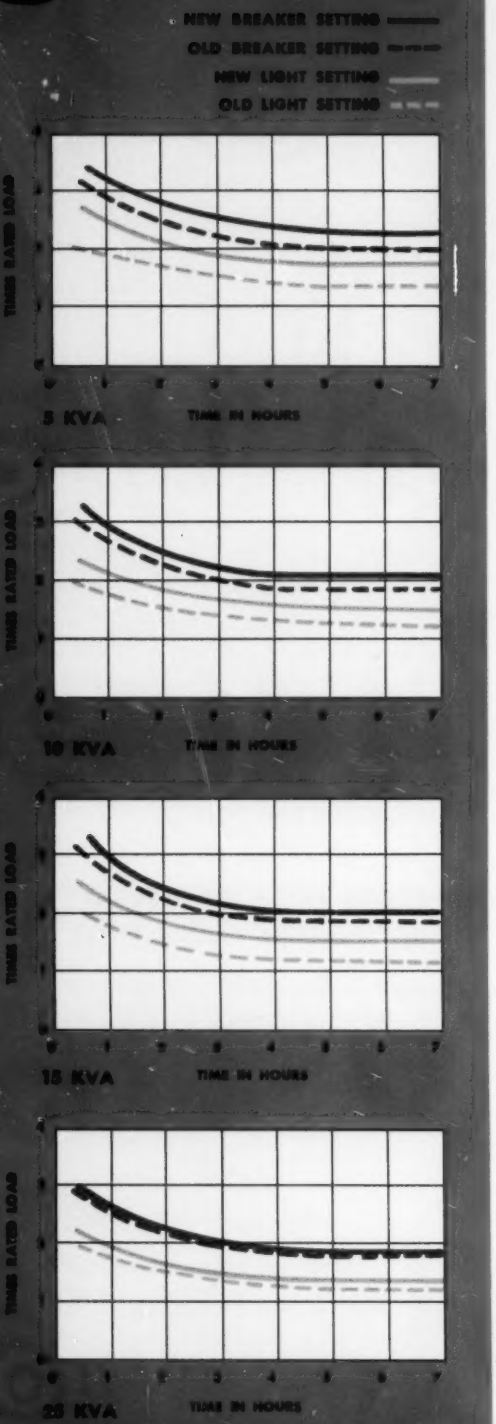
NEW 1959 GENERAL ELECTRIC DISTRIBUTION TRANSFORMER REDUCES UTILITY OPERATING AND MAINTENANCE COSTS



LIGHT AND BREAKER SETTINGS are uprated on new G-E Type HSBA distribution transformers. The new settings make usable the increased loadability which Permalex insulation provides. Curves are based on 7200-volt ratings, 75 percent initial loading, 35 C ambient.

NEW Higher Light and Breaker Settings Make Extra Loadability Usable

The new 1959 General Electric distribution transformer establishes a logical, comfortable load-growth margin over the entire kva range for self-protected units. New light and breaker settings provide greater margins than the pre-1956 settings, thus avoiding "hot-weather" tripouts as air conditioning loads increase. Yet settings are not unrealistically far apart.

The new light and breaker settings reflect utility requirements to avoid both the too narrow margins prior to 1956 and too wide margins which make it difficult, if not impossible, to use the light as a warning for the coming changeout. Settings on the new General Electric Type HSBA distribution transformers make it simple to plan changeouts in advance, without any change in utility operating practices. And only on the new G-E transformer do you get these higher light settings and the resulting operating savings.

A new, red-bordered nameplate on transformers with Permalex insulation provides easy, positive identification of the increased loadability for both conventional and self-protected transformers. For users of HSBA transformers this nameplate will also identify the increased breaker settings. Important as it is, Permalex insulation is just one of . . .

10 REASONS WHY GENERAL ELECTRIC IS YOUR BEST TRANSFORMER BUY

1. **New Permalex Insulation** increases transformer loadability by 20%.
2. **New Melalast Finish** on cover ends outages caused by animals.
3. **Formex Wire** helps cut size and weight, makes handling and changeouts easier.
4. **AL/CU Terminals** provide sure electrical contact with both aluminum and copper conductors.
5. **Strenicor Clamps** virtually eliminate secondary terminal failures and resulting service calls.
6. **Stainless Steel Bands, Nitrile Rubber Gaskets** simplify maintenance, resist corrosion.
7. **Impulse Testing** at factory assures extra years of reliable service.
8. **Self-Protected Transformers** are equipped with superior Thyrite* Magne-valve arresters.
9. **Computer-Controlled Ordering System** speeds delivery, helps reduce utility inventories.
10. **Careful Packaging,** guided by impact and vibration tests, cuts shipment damage.

Ask your G-E sales engineer for further details on the savings provided by new Permalex insulation and Melalast finish—and the 10 reasons why General Electric is your best transformer buy. Or write for bulletin GEA-6070 to G.E. Co., Section 431-85, Schenectady 5, N. Y.

*Reg. Trademark of G. E. Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Distribution operations for the Baltimore system are decentralized by providing seven service centers such as shown here in outlying areas. Each is equipped for all types of overhead construction.

Distribution plans and practices for a metropolitan system

By E. A. Chiarito
and W. H. Lucas

Engineers
Distribution Dept.
Baltimore Gas and Electric Co.

◆ THE AREA served by the Baltimore Gas and Electric Company comprises approximately 2,300 square miles, including Baltimore City and all or part of eight counties in the State of Maryland. For many years a portion of the overhead line construction force has operated on a decentralized basis from five "service centers" located in outlying sections of the territory. These service centers are fully equipped for all phases of overhead construction and include line crews, vehicles and equipment, storeroom, trouble crews, and dispatchers.

The growth of the load following World War II and the attendant increased overhead line construction program produced the economic need for modernization of existing centers and construction of additional service centers. There are now seven such district centers in addition to the central office in Baltimore City.

Several years ago, in an effort to increase efficiency and produce further economies, the decentralization of engineering and line-layout personnel, map records and draftsmen was begun and has thus far been fully carried out in two service centers and partially in three others. The other two service centers are scheduled to be similarly staffed in the near future.

All distribution engineering within the district including load and voltage analysis, planning of new 4 kv feeders and equipment, budget preparation, and system design in connection with new substations are handled by the district engineer, usually aided by one or two technical assistants.

Snowstorm experiences

The severe snowstorm of March 19-20, 1958 caused extensive damage to our distribution and transmission system. The heavy, wet snow accumulation on wires caused failure of poles, crossarms, towers, and conductors. Our analyses of the effects of this storm has produced several changes in our emergency operating procedures and our overhead line construction standards. The more significant of these developments are as follows:

1. Use of helicopters

Immediately after the storm, the Baltimore Gas and Electric Company made use of helicopters to supplement ground patrol crews by flying along 110 kv transmission lines and later to survey less accessible portions of the 4 kv distribution system. The helicopters were very effective in facilitating the location of damaged equipment.

Since the snowstorm, we have expanded our helicopter usage to include patrolling transmission lines following trouble operations, determining likely transmission line right-of-way routes and substation sites, and aerial photography.

2. Revised storm procedure

In the late stages of service restoration following the snowstorms, it became desirable to concentrate a large number of line crews in one of our outlying districts because of the magnitude of work remaining to be done in that district. These

These two transportation "tools" help the system operating personnel get over the 2,300 square mile area served by Baltimore Gas and Electric Co. The company has three of the "weasels" shown above which are primarily for emergency usage to transport men and materials to inaccessible locations. Helicopters such as shown below have proved useful for damage surveys after storms as well as for right-of-way studies.

crews represented about ten times the normal complement for this district and the facilities at the service center (office facilities for organizing and dispatching inspection and line crews, storeroom facilities for loading material, etc.) were not adequate to handle this force. In order to operate efficiently during this severe emergency, the district was divided into four parts by setting up three additional headquarters and the crews were assigned to the various headquarters with each group functioning independently.

As a result of this operation, our procedures for handling similar severe emergencies have been revised. Each of our seven suburban and rural districts and the Baltimore City district has been subdivided into from two to four areas with a total of 29 such areas. The headquarters for the 21 additional areas will be located in community buildings such as fire departments, American Legion Posts, etc., and negotiations are nearing completion for the use of these properties during severe emergencies.

Each area headquarters will be the base of operation for inspection teams, line crews, line material, and the office personnel necessary for interpreting damage reports from inspectors and coordinating the work of line crews. Approximately 1200 employees are being trained to assist the Electric Distribution Department during emergencies, including 1000 who have been trained to inspect overhead lines to determine damage. The majority of these employees will function in the area headquarters. To expedite mobilization, each employee is assigned to the area headquarters nearest his home.

3. Revised construction standards

Our analysis of the damage sustained by our distribution and transmission system during the snowstorm showed that, although it would be economically prohibitive to build the system so as to withstand the tremendous loadings imposed by such a storm, certain changes could be made at a reasonable cost which would materially reduce damage.

Pole failure was our most significant source of trouble and accounted for the greatest portion of time required to restore service. Because of the number of failures of class 6 and 7 pine poles, their use has been discontinued by substituting class 4 and 5 in our construction standards. To minimize deadend and corner pole failures caused by anchors pulling out of the ground, we are now using 10-inch anchor plates instead of our former 8-inch standard.

Top groove instead of side groove insulators will be used on new 4 kv construction as a result of the number of cases of conductors rolling off the insulators onto the crossarm. Future 4 kv construction will also incorporate steel pins instead of wood pins because of the wood pin breakage experienced in the snowstorm.

For several years we have fol-

lowed a service continuity program wherein considerable attention has been given to improving the reliability of the 4 kv distribution system. The program includes extensive tree trimming as well as the use of preassembled aerial cable and spacer-type cable where tree trimming is economically prohibitive or permissions are unobtainable. During this period approximately 300,000 circuit feet of aerial cable has been installed on the 4 kv system. Damage caused by trees during the March snowstorm was relatively light. Damage to aerial cable occurred at only two locations wherein one phase of spacer-type cable failed due to large trees falling. This effectiveness of our service continuity program was gratifying.

An interesting development of the snowstorm concerns a 110 kv tower line river crossing wherein hardware failure allowed the overhead ground wires and conductors to drop into the river. Had the hardware not failed, the conductor strength was such that additional snow load would have resulted in tower failure. This experience indicates that all transmission lines should be designed with a weak link to fail before the tower does. The increasing size and strength of transmission conductors dictates that the weak link should be a specific piece of hardware designed to fail before the tower. The Baltimore Gas and Electric Company is studying this problem and and plans to incorporate such weak links in transmission line design.

Digital computers show promise

The long, tedious and repetitive calculations involved in determining voltage profiles of distribution feeders lend themselves to the use of digital computation for obtaining more rapid results. This tool will enable us to quickly and economically monitor the distribution system; troublesome circuits can then be easily selected for more detailed analysis.

We have had some limited experience with a program, written for the IBM 704 computer, that applies voltage regulators and capacitors (fixed and switched) and the various combinations to satisfy pre-selected voltage limits on a distribution feeder. We expect to acquire additional experience with the method in the near future and be in a better position to appraise its usefulness. However, the results obtained thus far look very promising.

Some of our unit substations (1500 kva to 7500 kva 33/4 kv) are supplied from two 33 kv sub-transmission circuits. To avoid the cluttered appearance of a three pole structure on the road opposite these substations, underground taps are provided between the overhead line and transformer. Direct burial of 33 kv cable is employed to reduce costs.

Direct burial of underground cable has also been extended to 4 kv primary and secondary distribution circuits. This practice, when coupled with the installation of padmounted transformers or enclosures for pole-type distribution transformers, makes underground installations more attractive than when comparisons are made between conventional underground and overhead construction.

Our first such installation was the transformer enclosure type located on the waterfront for providing 120/240 volt service to a U. S. Army facility. Other installations are being planned utilizing self-enclosed CSP pad-mounted transformers. The first on order is a 15 kw, 2400-120/240 volt single-phase unit, with approximate dimensions of 21″ x 27″ x 22″. High side bushing and secondary terminals are accessible by unlocking and removing a side box-like cover. A clamp-type ground connector is available on the outside of the welded cabinet for grounding. Larger three-phase units (up

Direct burial of 33 kv cable occurs at some of the unit substations served by two 33 kv sub-transmission lines. These underground taps between the overhead lines and transformers avoid the cluttered appearance of three-pole structures on the roads opposite these substations.

to 150 kva for 120/208 service) are also contemplated in the very near future.

Plans are also under way for installing 100 kw and 167 kw 2400/120/240 volt single-phase pad-mounted transformers for supplying a new apartment development. Primary taps to these transformers will be directly buried and originate from an aerial cable line to be constructed around the periphery of the development. Secondaries emanating from the pad-mounted transformers will also be buried and terminate in the basement of each apartment group.

Our Underground Lines Division remove and scrap cable from the conduit system each year. The pulling and cable reeling process normally requires an eight-man gang. After the cable is reeled it is transported to the storeroom yard for unreeling and cutting into suitable lengths.

In accordance with our mechanization program for improving materials handling methods, we have recently developed a machine that combines several of the previous scrapping operations in one and requires no more time than was needed for the cable pulling process alone. Moreover, a five-man gang is all that is required.

The machine is mounted on a three wheel trailer and can be easily towed to the job. Once set up, the machine pulls cable from the duct and cuts it into four-foot lengths, at the rate of approximately 10 feet per minute, in a continuous, automatic operation.

The trailer, affectionately named "The Robin" by our shop mechanics, is living up to design expectations.

ACSR conductors used

Our fifth generating plant, the C. P. Crane Station, is presently under construction. Its ultimate development calls for at least four generating units, the first of which will have a capacity of 191,000 kw. The 110 kv outgoing circuits are not expected to be bussed; the output of each generator must therefore be carried over its corresponding transmission circuit. The relative economies of different circuit arrangements for the various possible loading conditions were studied. As a result, the transmission line linking the proposed unit with the 110 kv system will utilize 2,167,000 C.M. ACSR conductor, the largest installed to date on our system.

Considerable use is being made of underground circuits using direct burial cable for both 4 kv and secondary circuits. This enclosure, located on the waterfront to serve a U.S. Army facility, houses a 15 kw line-type transformer connected to underground circuits.

Direct burial of distribution circuits is facilitated by the use of trenching machines such as the one shown in operation here. This machine digs a trench up to 6 inches in width and 30 inches deep.

Selection of lightning arresters

By E. Beck

Manager
Lightning Arrester Section
Distribution Engineering Dept.
Westinghouse Electric Corp.

◆ IN SELECTING a lightning arrester, it is important to know the probable voltages between phase and ground during normal and abnormal conditions, such as faults, dropping of load, runaway, etc. Arrester rating is usually based on the voltages during faults. If other causes of sustained overvoltage are probable, they should be evaluated, or the causes eliminated.

The voltage rating, on the nameplate, is stated in 50-60 cycle volts or kilovolts rms. It defines the maximum 50-60 cycle voltage (applied to the arrester terminals) against which it will interrupt follow current and restore itself as an insulator, after having been discharged by a surge. Neither the 60-cycle sparkover nor any other characteristic of the arrester defines that ability.

Currently available arresters are called 100, 80, and 75 per cent arresters. The 100 per cent arrester has a rating related to the system voltage—five per cent higher than the rated circuit voltage. It is used on isolated neutral systems or systems grounded through high impedance.

The usual power distribution system in North America is the grounded neutral system. On the effectively grounded system, arrester rating bears no direct relation to system voltage. Whether 80 or 75 per cent arresters are applicable depends on the impedance ratios of the system (Figure 1).

Figure 1 shows the relation between the highest voltage to ground of a sound phase and the circuit characteristics for systems whose neutrals are grounded. The parameter is the ratio of the maximum voltage that appears between phase and ground to the line-to-line voltage before the fault. The curves are the loci of the values of R_0/X_1 and X_0/X_1 for which this ratio is the value attached to the curve. Within the area under any curve, this ratio is less than the fraction identifying the curve. For example, if X_0/X_1 is 3 and R_0/X_1 is 1, the point lies below the curve marked 0.8; eighty per cent arresters may be applied.

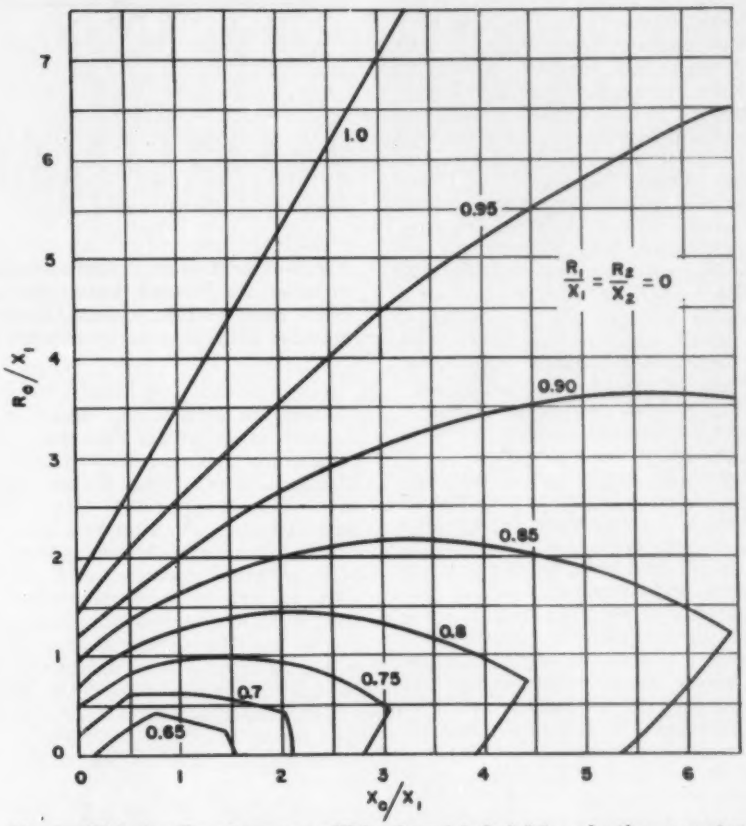


Fig. 1—This family of curves will be found helpful in selecting arrester ratings for effectively grounded systems. It shows for systems whose neutrals are grounded the relationship between highest voltage to ground of a sound phase and the circuit characteristics. Example: if X_0/X_1 is 3 and R_0/X_1 is 1, the point lies below the curve marked .8 and eighty per cent arresters may be applied.

The curves are based on $R_1/X_1 = R_2/X_2 = 0$. The circuit resistance is considered negligible, so the curves may be conservative for some systems. Other curves are available for higher values of R_1 and R_2, for which the voltages to ground will be lower.

If the system frequency voltage exceeds the arrester rating and discharges, it is in danger of being damaged. Just a voltage rise above the arrester rating will not cause damage because the arrester will not discharge until this voltage is considerably above the arrester rating. However, if it is discharged then by a surge, it may not be able to interrupt the follow current.

Figures 2 and 3 show Autovalve arrester operation with a voltage less than the arrester rating applied, and the result if the applied power frequency voltage exceeds the arrester rating.

The first oscillogram (Figure 2)

is a trace of 60-cycle voltage applied to the arrester; no current flowed through the arrester. After a surge was applied, part of a half cycle of follow current flowed and was interrupted when the current went through zero.

In Figure 3, the applied 60-cycle voltage was 65 kv, 30 per cent in excess of the arrester rating. Again, as the 60-cycle voltage only was applied no current flowed through the arrester. However, when the surge was applied follow current flowed, higher than in the first oscillogram. The arrester was incapable of interrupting this follow current because it had two strikes against it: (1) the follow current was a good deal higher thus making it tougher for the gap to interrupt; and (2) the gap was called upon to interrupt against a higher voltage.

Damage to station-type arresters of up-to-date construction is rare. When it occurs, the cause very often is some unforeseen condition that exposes the arrester to a voltage higher than its rating. However, there may be occasions when (to save in capital investment) some risk of arrester failure may be considered.

Such conditions probably occur more often than is realized. For example, it may be that in some installations the 60-cycle voltage applied across arresters at times exceeds the arrester rating; fortunately, the several factors that might lead to damaged arresters do not occur always simultaneously. It is better to damage a lightning arrester rather than to damage an expensive piece of equipment, and to cause a major power interruption.

When an arrester fails

Sometimes an arrester failure does occur. If an arrester is damaged electrically, it turns into a short circuit. System fault current flows through it. This creates internal gas pressure, which is some function of the fault current. If the current is high, the pressure may shatter the porcelain housing and damage adjacent apparatus. Arresters not equipped with effective pressure relief devices have virtually exploded from high internal pressures — created by fault current that flowed when the arrester was damaged and became a short circuit.

Figure 4, a cutaway section of an Autovalve station-type arrester unit, shows the valve elements and the series gap. This series gap, by

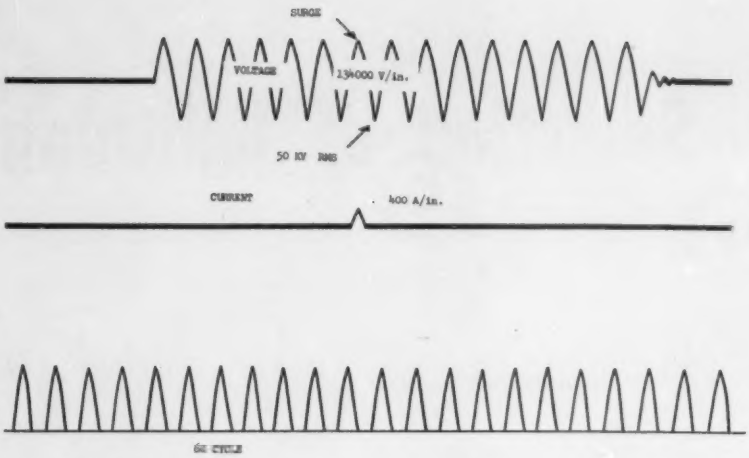


Fig. 2—Oscillogram resulting from duty cycle test on 50 kv station type arrester. No current flowed through the arrester as a result of the 60 cycle rated voltage applied. After a surge was applied, follow current resulted but was interrupted after a half cycle flow.

the way, is hermetically sealed in its own housing; it is then assembled in the main arrester housing. The Autovalve arrester is now the only arrester that has such a separately sealed series gap.

This interrupter incorporates a very effective pressure relief device, proved by both laboratory tests and field service. The plates at the top and bottom of the arrester housing are frangible diaphragms of cast aluminum. If the arrester short circuits, fault current flows, and the resulting pressure breaks the frangible diaphragms.

Development tests in the high power laboratory showed that breaking the diaphragms, or even leaving the ends of the porcelain open, would not prevent the porcelain from bursting if high system fault currents existed. However, the protuberance at the side of the housing are an important adjunct —they are gas ports. When the diaphragms break, hot ionized gas flowing out of the top is deflected downward and the gas from the bottom is deflected upward.

Arrester fails safe

When these two gas streams meet, the arc is transferred from inside the housing to the outside, and pressure is no longer generated. The transfer takes place in a half cycle. This contrivance assures that in case of damage the arrester will fail safe.

The pressure relief device has been used since 1950. There have been several operations of it. No porcelain has been shattered or broken.

The Westinghouse line-type (now called intermediate-type) arrester, also incorporates a relief device. In case of prolonged flow of 60-cycle current, a lead disc provided at the bottom will be punctured by an arc and release the gas pressure. The line-type arrester does not have gas deflecting devices. The relief device in the line-type arrester does, however, prevent the arrester from holding gas pressure in an installation where fault current is relatively low.

The Mobilarc gap

Another safeguard—this against damage to the arrester—has been incorporated in both the station and line-type arresters. It is the Mobilarc gap.

Inside the formed electrode is a ring-shaped permanent magnet (Figure 5). It is polarized so the magnetic field cuts across the sparking space. Consequently, the arc motors around the circular electrode; this permits no burning.

The Mobilarc gap is simple and effective. A full strength magnetic field is always present, regardless of the current discharged through the arrester. There are no coils, auxiliary gaps, or soldered connections. It has been devised principally because of the emphasis recently on switching surge discharges. Under switching surge conditions, extended arrester discharge current can exist, and without some way of moving the arc,

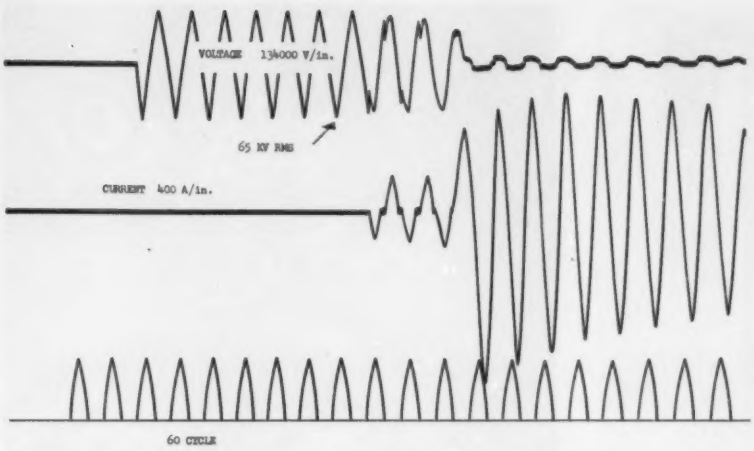


Fig. 3—In this test, 60 cycle voltage applied was 30 per cent in excess of arrester rating. No follow current flowed through the arrester as a result of the 60 cycle voltage, but when the surge was applied, follow current resulted, and the arrester was unable to interrupt it.

it would remain in one spot, producing pits and/or welts.

As an example of the protection this provides, an instance is cited in which four discharges of approximately 500 amperes occurred, lasting sowewhat over 2000 microseconds. The electrodes in the two arresters used, one with and one without magnets, were subjected to the same four discharges.

The electrode in the arrester equipped with magnets showed hardly a trace of burning, while the other showed several welts and pits.

Introduction of the magnet also increases somewhat the follow current interrupting ability of the gaps.

Compact high-voltage arresters

In the past, high-voltage arresters were built physically high, and so required mechanical bracing. To overcome this, newly-designed arresters are built of individual units, rather than a single element. Compared to former models, they are lower in height and larger in diameter; as a result, they are self-supporting.

Inside each unit there are three stacks of elements, physically in parallel, electrically in series (Figure 6). Two columns contain series gaps and a few blocks; the third column is all blocks. The arrangement is symmetrical, i.e., the discharge current comes in through a gap, passes down through the blocks, moves up through the column of blocks, then down a few blocks and out through another series gap. Shield plates are included in the units; these (and the symmetrical arrangement) provide good voltage distribution in addition to that provided by the resistors that shunt the gap elements.

The assembly is very rugged. All

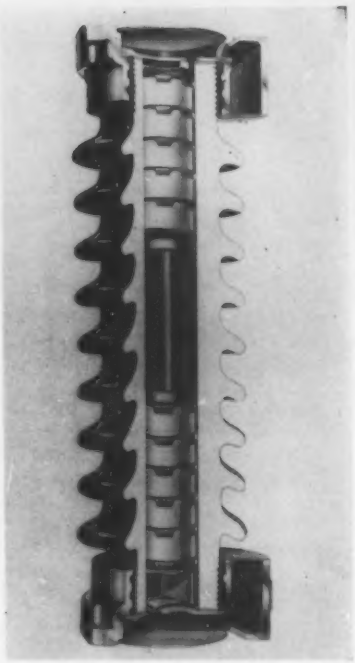


Fig. 4—Cutaway view of type SV Autovalve station type arrester, showing the valve elements and the series gap. Text describes the pressure relief device incorporated in this design.

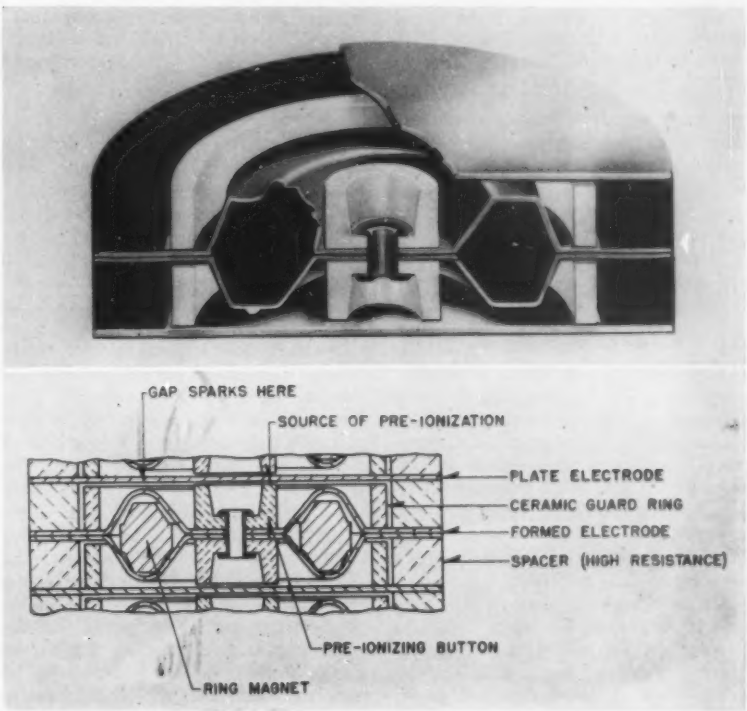


Fig. 5—This drawing shows details of series spark gap element of Autovalve station and line type lightning arresters. Ring magnet functions to motor the arc around the circular electrode, preventing burning.

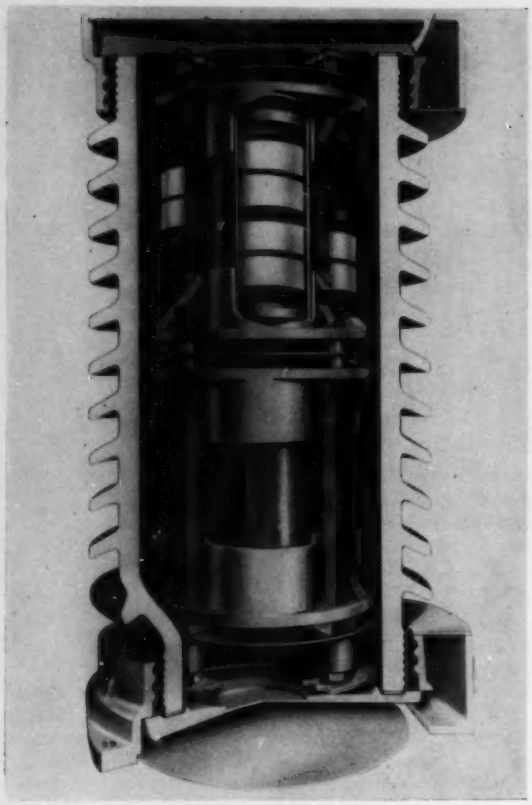


Fig. 6—This cutaway view of the SVS Autovalve station type arrester shows the three stacks of elements, physically in parallel, electrically in series, which results in numerous advantages.

Fig. 7—Using the units shown in Figure 6, station type arresters are rugged, lower in height, larger in diameter, and self-supporting. The complete unit illustrated here is rated at 350 kv.

the parts are put together before they are placed inside the porcelain housing. Considerable attention has been given to mechanical strength, to prevent damage during transportation. These units are provided also with a pressure relief system. Figure 7 shows an arrester rated 350 kv.

Switching surges

The matter of the switching surge voltages becomes of concern on high-voltage systems. Arresters are relied upon to limit the magnitude of switching surge voltages that might occur if the lines are switched with breakers that restrike. This is quite unusual with modern breakers, but it might occur occasionally.

Some concern has been expressed whether arresters are able to handle these discharges. Switching surges have been with us for many years, arresters have been used for many years, and lines have been switched for many years. In the past, they have been switched with breakers that restrike more than the breakers manufactured today. No resulting epidemic of damage has been noted. However, it is a problem; work has been done to increase the ability of station-type arresters to withstand such discharges on long high-voltage lines or cables.

A criterion adopted in the American Standards calls for an arrester to satisfactorily withstand discharge of a rectangular wave for 2000 microseconds with current above a stated value. (Autovalve arresters will stand at least 500 amperes of such discharge without damage to either the valve elements or the gap.) Unfortunately, this test does not represent what goes on when the line is switched. There is only one condition when the switching surge discharge through an arrester can be a rectangular wave: if the impedance of the arrester at the current discharged is equal to the surge impedance of the line. This is true only for one combination of rated circuit voltage and arrester rating. For overhead lines it is in the region of 34 to 46 kv. In this range the switching surge problem does not exist.

On high-voltage lines, the arrester impedance at the currents discharged is higher than the surge impedance of the line, hence the discharge will take place as a series of reflections resembling an expotential discharge (like the discharge of a capacitor through a resistance).

A switching surge voltage sufficiently high to cause an arrester operation may force the arrester to discharge all the energy stored in the line switched. This may amount to a considerable number of watt-seconds. It will discharge through the arrester in the form of a current of relatively low crest (in the hundreds of amperes), decaying with time, and of long duration.

The magnitude and the nature of the current discharged by arrester may vary with the type of arrester and its characteristics. However, the arrester is subjected

(Continued on page 124)

Chart simplifies service calculations

By C. K. Jones

Overhead Planning Engineer
City Public Service Board
San Antonio, Texas

◆THE SIMPLIFIED chart shown here has been developed and incorporated in our construction standards for use by engineering and construction personnel in determining the size of electric services for given loads and distances.

The design factors used in the preparation of this chart were (1) Voltage drop of 1.6% from the main line secondary or the transformer; and (2) Current carrying capacity of the single conductors.

On small loads, the limiting factor is voltage drop, but for large loads the current carrying capacity of the wire is the limiting factor.

In the use of triplex or cable, the limiting factor may be the insulation on the wire. The shaded areas on the chart indicate this limitation.

Examples given below show how to determine correct size of service for any given load and service length.

Used also along with this chart is a conversion table for obtaining the current value for loads given in kva or hp at 240 or 440 volts.

Voltage drop calculations were made according to electric line and loss rule.

How to use the chart

Special notes on the chart: (1) Curved areas used for voltage limitations; (2) Shaded areas indicate "K" or Triplex limitations.

To determine service wire size: Locate length of service on left side of chart; then locate kva at top of chart. The intersection of these lines will indicate wire size.

For 240 volts, 1-phase, use kva demand.

For 240 volts, 3-phase, use one-half of kva demand.

For 240 volts, 1-phase and 3-phase hot wires use 1-phase kva demand plus one-half of 3-phase kva demand.

For neutral when hot wires are larger than #4 copper use one-half of 1-phase kva demand.

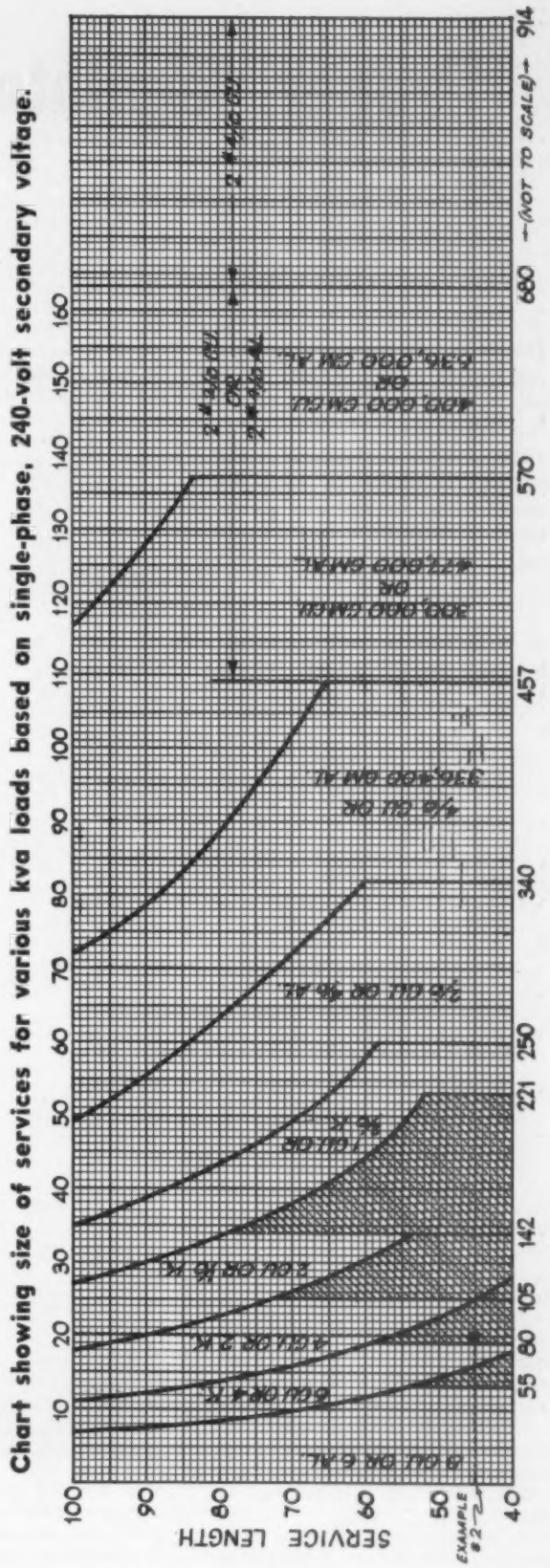
Examples

(1) Given 23 kva, 1-phase, 240 volts, 70 ft. length — Point falls in #4 copper or #2 aluminum limits.

(2) Given 20 kva, 1-phase, 240 volts, 45 ft. length — Point is in shaded area beyond #4 "K" limits but within #6 copper limits. Use #6 copper or #2 "K".

(3) Given 46 kva, 1-phase, 240 volts, 70 ft. length — Use #1 copper for hot wires, #4 copper for neutral.

(4) Given 20 kva, 1-phase and 35 kva, 3-phase, 240 volts, 90 ft. length — 1-phase kva plus one-half of 3-phase kva is 37½ kva; use #1 copper. For 3-phase high leg use one-half of 3-phase kva demand or 17½ kva which indicates use of #4 copper. For neutral use one-half 1-phase kva demand or 10 kva which indicates #6 copper. However, do not use more than two sizes of wire for service; thus use two #1 copper and two #4 copper.



Proper regulator compensation

By Howard C. Brem
and Robert F. Gilton
Regulator Dept.
Allis-Chalmers Mfg. Co.

This is the seventh and concluding article in the special series on regulators which began in the December 1958 issue. Previous articles in the series dealt with such topics as regulator application, ratings and proper location, loading and overloading, and paralleling problems.

◆ WITH THE LINE DROP compensation part of his regulator controls (Fig. 1), the utility user can minimize effects of resistance and reactance line drops and give correct voltage at the load center. Better average voltage at other points along distribution lines is also obtained.

A uniformly loaded system, Fig. 2A, is shown with a regulator and the line resistance and reactance. The voltage profile of the system without compensation is shown in Fig. 2B. With no load, there is negligible voltage drop; with increasing drop at half load and maximum drop at full load.

With compensation (Fig. 2C) there is a voltage improvement at the load center for all magnitudes of loads and also a decrease in voltage swing at the end of the line. There is an extensive area of voltage improvement enclosed in the dotted line clearly indicating the benefits of compensation. This voltage improvement results in increased power consumption for the utility as well as increased customer satisfaction.

In using compensation, the voltage drops are a function of load current and it is therefore, necessary to measure the load current. For standardization and to allow interchangeability in the field, the secondary current corresponding to full load current is a fixed value regardless of regulator rating.

In addition to the current transformer, a resistor and a reactor are added to the regulator control for the compensator. These two circuit elements are variable and are adjusted to supply the necessary values for each individual application. A simplified control diagram is shown in Fig. 3.

The components in Fig. 3 labeled Voltage Level Adjustment and Voltage Regulating Relay, are part of the conventional voltage sensitive control circuit. The resistance and reactance elements of the compensator are in this series circuit.

With compensation, the current from the C. T. flows through a portion of the resistance and reactance elements of the compensator and a voltage drop is introduced into the control circuit. This voltage adds to or subtracts from the voltage on the voltage regulating relay, and causes the regulator control to raise or lower the regulator output voltage.

With values of resistance and reactance proportional to line resistance and reactance and the current from the C.T. proportional to

Fig. 1—This group of single-phase regulators are each provided with a control panel providing adjustments for voltage level, resistance and reactance compensation, control test knob, and a switch for selecting manual or automatic operation.

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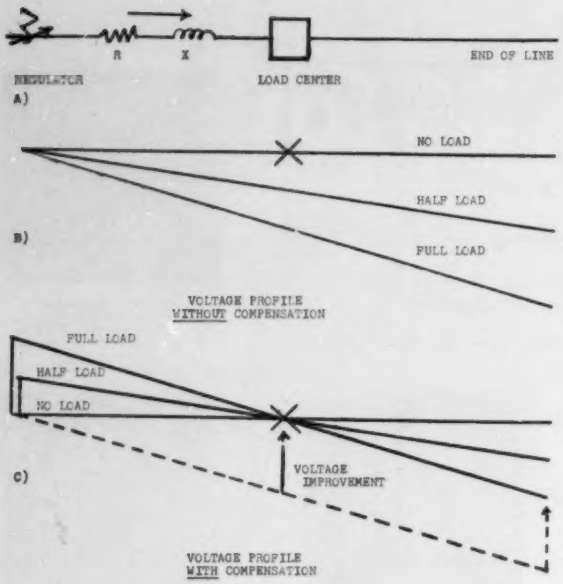

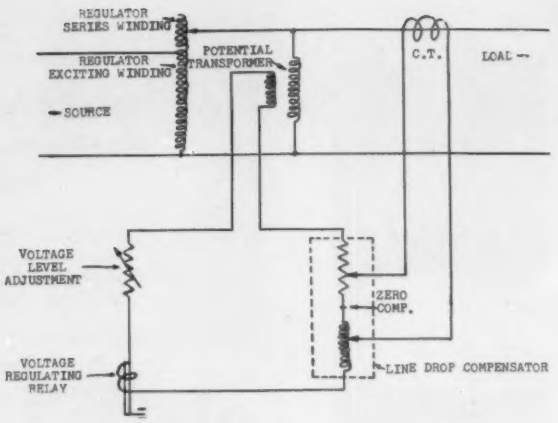

Fig. 2 (Left)—Diagram showing typical feeder and voltage profiles with and without regulator compensation.

Fig. 3 (Above)—Simplified regulator control diagram showing line drop compensator.

the load, the voltage drops across the compensator elements are proportional to the voltage drops on the line. The regulator then maintains a constant voltage at the selected load center and the compensator circuit is a miniature power line.

Line resistance and reactance cause a voltage drop on the line when the load current is lagging. When the compensator causes the voltage across the voltage regulating relay to decrease, the regulator control causes the regulator to raise its output voltage. During leading power factor load conditions, the compensator circuit could cause the regulator to lower its output voltage, depending on the amount of reactance compensation compared to resistance compensation.

Thus the compensator provides proper control regardless of power factor. It is unnecessary to make control changes because of power factor.

Calculating values

The values of resistance and reactance for various sizes of conductor must be obtained from tables such as Nesbit's "Characteristics of Transmission Circuits" or similar data. To find the value of resistance per conductor per mile, use the conductor size in the left hand column of the table. Read the value of resistance per mile in the column under the proper conductor material. The remaining columns of the table will list values of reactance under the heading of "D." The proper value of "D" depends upon conductor spacing and is equal to $\sqrt[3]{A \times B \times C}$ for a three phase system, the values of A, B, and C being the distances between the three phase wires of the circuit.

In a symmetrical triangular spacing, A, B, and C are each equal to each other. In a regular flat space configuration, C is equal to A plus B, and A is equal to B. In an unsymmetrical triangular spacing, A, B, and C may all have different values but the formula given above for "D" will take this into account. In an irregular flat spacing, C will equal A plus B, but A will not be equal to B.

In a single phase circuit, "D" is the distance between the two conductors. To find the line reactance per mile, locate the wire size in the left column of the table. The reactance will appear opposite this number under the correct value of "D." The resistance and reactance values are per conductor per mile. The equations for calculating the resistance and reactance settings in volts are as follows (See Table I for K):

Resistance setting (volts) =

$$(\text{Res/mi/cond}) \times (\text{No. miles}) \times \frac{(\text{CT rating})}{(\text{PT ratio})} \times \text{"K"}$$

Reactance setting (volts) =

$$(\text{React/mi/cond}) \times (\text{No. miles}) \times \frac{\text{CT rating}}{\text{PT ratio}} \times \text{"K"}$$

An example demonstrates the mechanics of using the foregoing information to calculate the compensator settings for a circuit without shunt capacitors installed.

Example

Regulator nameplate rating: 50 kva, line voltage 2500 volts, control voltage 125 volts, (20/1 Ratio) CT primary rating 200 amperes.

Table I — Constant "K" for calculating regulator compensation settings

Circuit type	P.T. connection	"K"
1 ϕ	Line to neutral	2
Y	Line to line	1.732
Y	Line to neutral	1
Open or (1 ϕ unit)	Line to line	1.732

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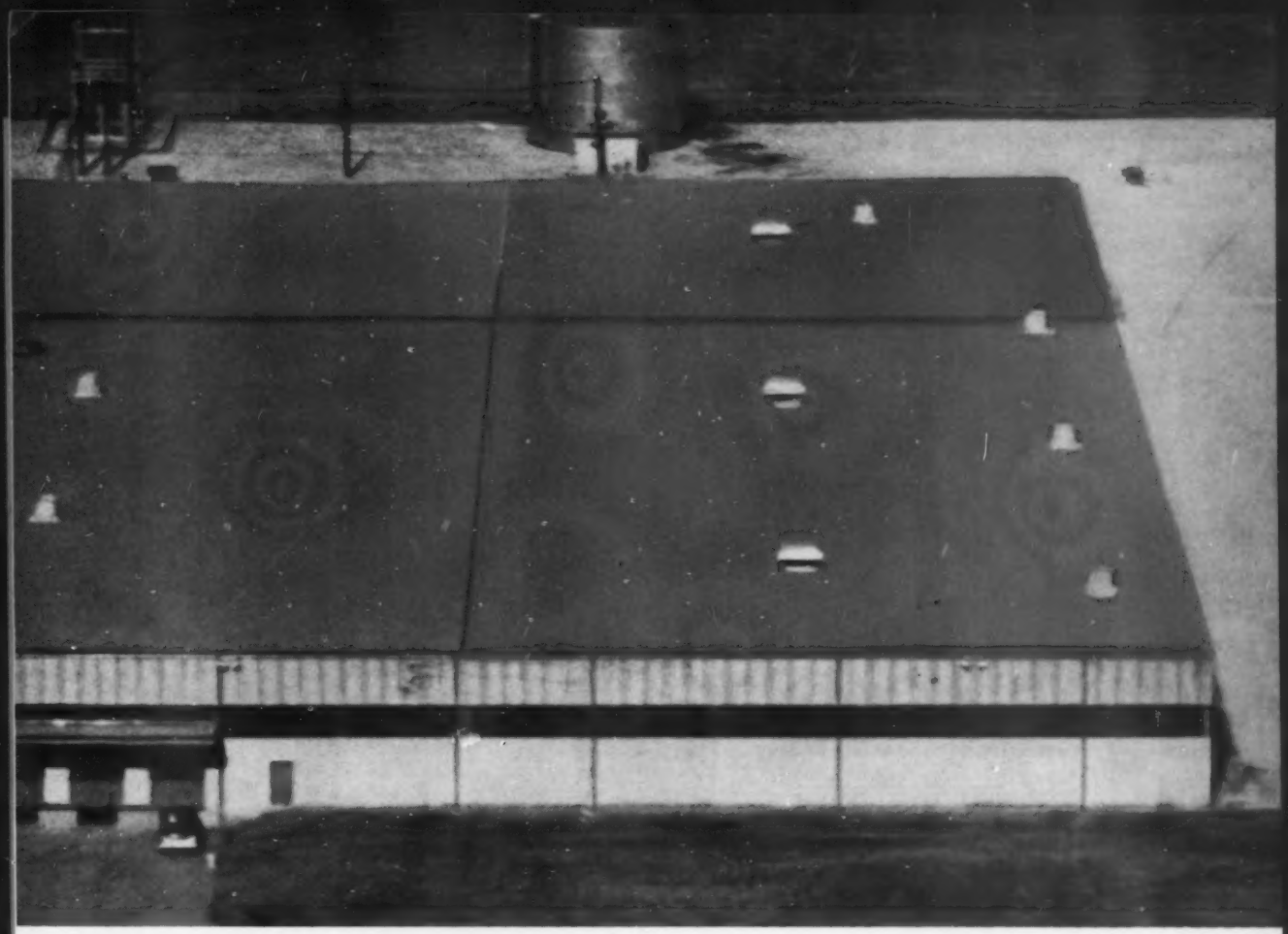

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ANACONDA®
COPPER AND ALUMINUM WIRE & CABLE

Conductor—No. 2/0 stranded copper

Conductor spacing—36" symmetrical triangular spacing

System connection—three single phase units in wye on a three phase line

Distance to load center—three miles.

From the wire table the resistance is .440 ohms per mile and the reactance is .665 ohms per mile. (D=cube root of 36×36×36=36 in.)

For wye connected regulator, (See Table I) the multiplier is:

$$\frac{\text{(CT rating)}}{\text{(PT ratio)}} \times K =$$

$$\frac{200}{20} \times 1.0 = 10$$

Resistance volts drop=.440×10×3=13.2 (use 13 volts)

Reactance volts drop=.665×10×3=19.95 (use 20 volts)

These figures are then set on the control panel (see Fig. 1—The center knob at left is the reactance compensation; the lower knob, the resistance compensation.)

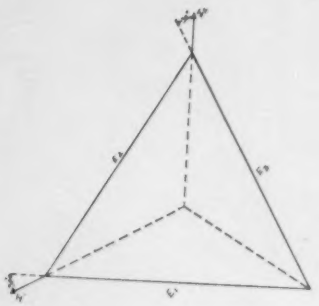


Fig. 4—Current and voltage relationships in open delta connected voltage regulator bank.

It is necessary to know both the current transformer and the potential transformer ratio (listed on the regulator nameplate). The CT rating is divided by the potential transformer ratio and multiplied by the constant K, which depends on the circuit and connection of the potential transformer.

This is all that is required to find the correct compensator settings for single phase or wye circuits. The same steps for delta circuits are followed but one additional step is required.

Calculation for delta circuits

If single phase units are used in open delta, there is a phase shift

(Continued on page 123)

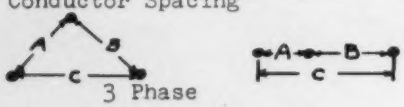
Typical line drop compensator work sheet. Table referred to in Item 13 is similar to Table I, page 60.

Item 1. Conductor Material _____

Item 2. Conductor Size _____

Item 3. Type of Circuit (Δ, Y or Single Phase) _____

Item 4. Conductor Spacing



A= _____

B= _____

C= _____

Item 5. Conductor Equivalent Spacing (D)

$D = \sqrt[3]{A \times B \times C} =$ _____

Note: - For Single Phase circuit D= Distance between the two conductors

Item 6. Distance to Load Center _____ Mi

Item 7. Regulator Current Transformer Primary rating (from nameplate) = _____ Amps

Item 8. Regulator Potential Transformer Ratio (from nameplate)= _____

Item 9. Potential Transformer connection if 3Ø Regulator (Line to Line or Line to Neutral) _____

Item 10. Resistance per conductor per mile = _____ ohms

Item 11. Reactance per conductor per mile = _____ ohms

Item 12. Divide Item 7 by Item 8

$\frac{\text{Item 7}}{\text{Item 8}}$ _____

Item 13. Select a value of K from the following table depending on Items 3 and 9

Item 14. Multiply Item 12 by Item 13 (Item 12)(Item 13)= _____

Item 15. Multiply Item 14 by Item 6 (Item 14)(Item 6)= _____

Item 16. Multiply Item 15 by Item 10 (Item 15)(Item 10)= _____ Volts
This is the resistance comp. setting (If open Δ or Δ circuit continue with Item 18 below)

Item 17. Multiply Item 15 by Item 11 (Item 15)(Item 11)= _____ Volts
This is the reactance comp. setting (If open Δ or Δ circuit, continue with Item 18 below)

Item 18. If this is an Open Δ or Δ circuit, figure values of R_1, X_1, R_2, and X_2 from Item 21, using Items 16 and 17. R_1=___ X_1=___ R_2=___ X_2=___
These are the corrected compensator settings for the regulators.

Item 19. If circuit is an open Δ, R_1 and X_1 are used on the regulator with the lagging current and R_2 and X_2 are used on the regulator with the leading current.

Item 20. R_1 and X_1 or R_2 and X_2 are used on all regulators in a closed Δ bank depending on whether the current lags or leads the voltage. If the current lags the voltage, use R_1 and X_1.

Item 21. Equations for calculating corrected compensation setting for open Δ or Δ circuits.

$R_1 = .866R - .5X$
$X_1 = .866X + .5R$

$R_2 = .866R + .5X$
$X_2 = .866X - .5R$

Item 22. Remarks

This "gold meter," General Electric's 10,000,000th magnetic-suspension meter, has just come off the assembly line at Somersworth, New Hampshire. It is a reminder that not one of the first 9,999,999 has ever been replaced because of bearing wear.

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This month, eleven years since the introduction of the revolutionary I-50, General Electric's Meter Department produced the 10,000,000th meter with magnetic suspension. Of the first 9,999,999, not one "free-floating" system has ever been replaced because of wear. This service record stands as indisputable proof that General Electric meters, with magnetic suspension, assure a lifetime bearing system. Here's how it started:

Meter men for many years had requested a meter with a lifetime bearing system. In 1948, General Electric introduced the I-50—first of the magnetic-suspension meter family—as the answer to that request. Because of the widespread acceptance of the I-50 and the need to handle increasing loads, General Electric introduced the Class 100 I-55 in 1954 and the Class 200 I-60 in 1957. With the extension of magnetic suspension to the complete polyphase Class 10, 100 and 200 V-60 two-stator line, General Electric's full line of watthour meters has achieved an unexcelled record for accurate performance.

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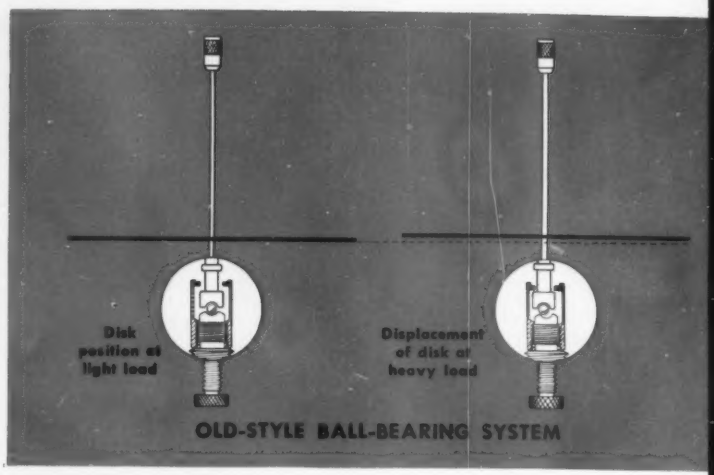
HERE'S 5-WAY PROOF OF MAGNETIC-SUSPENSION

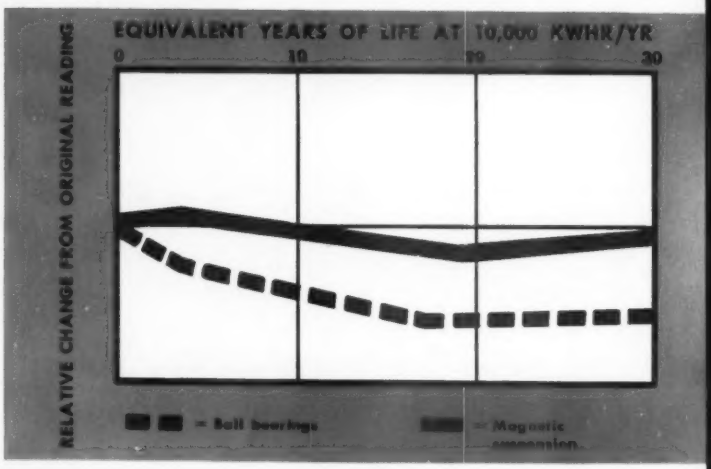
1 NO DISK DISPLACEMENT

With conventional ball-and-jewel bearing systems, higher loads can force the disk out of position and cause inaccurate meter readings. Because of the basic design of General Electric's magnetic-suspension system, however, disk displacement at any load is not a significant factor, and meter readings are accurate through full meter range. You also eliminate bearing inspection, cleaning and replacement costs.



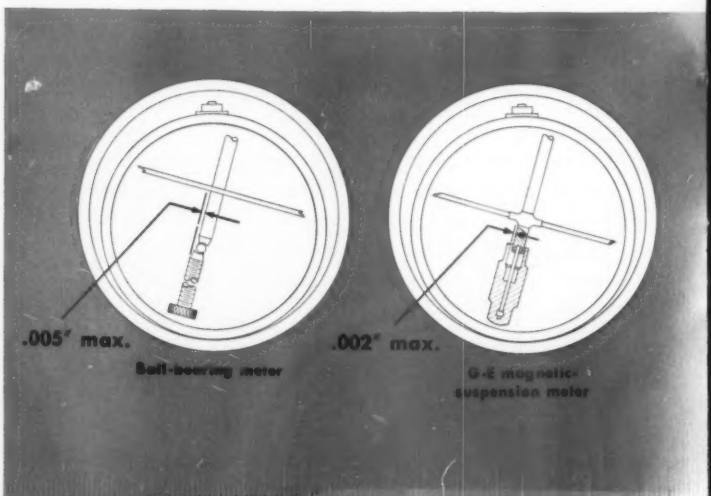
2 GREATER SUSTAINED ACCURACY

The proof is in the testing. Accelerated life tests prove that, over an equivalent of 30 years' operation at 10,000 kilowatt-hours per year, meters with magnetic suspension hold a higher sustained accuracy and incur considerably less bearing wear than meters with old-style, ball-bearing systems.



3 REDUCED TILT ERROR

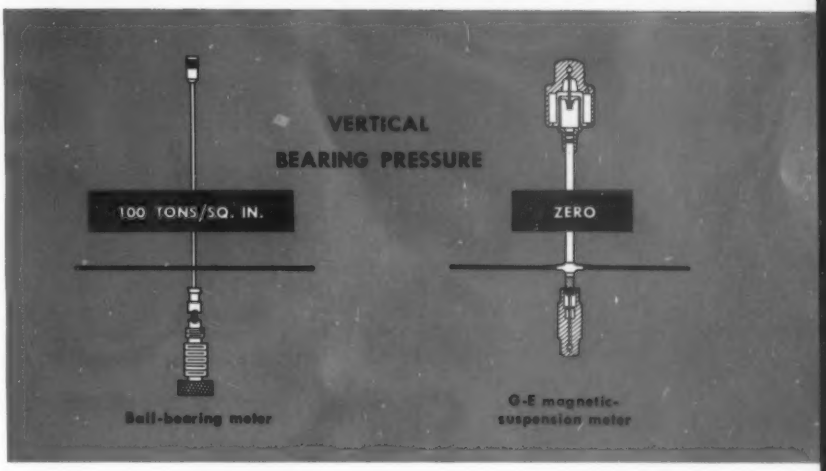
Because the disk and shaft in G-E meters are supported magnetically rather than by a ball and jewel, tilt error is minimized. As the angle of tilt is increased on ordinary ball-bearing meters, disk position changes—relative to the element and damping magnet—result in increased tilt errors. Close tolerance of parts in G-E meters minimizes disk position changes and tilt error, thus reducing revenue losses.



GENERAL ELECTRIC'S METER SUPERIORITY

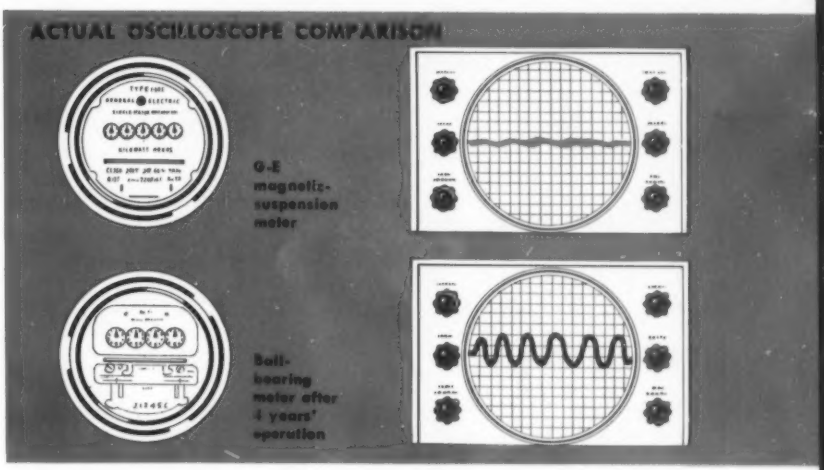
4 NO BEARING WEAR

In old-style, ball-and-jewel systems, the weight of the disk and shaft assembly exerts approximately 100 tons-per-square-inch pressure on the bearing. Bearing wear and attendant maintenance costs are inevitable. With G-E's magnetic-suspension system, vertical bearing pressure is zero because the entire weight of the rotor is supported by a magnetic field. Only G-E meters offer a true, lifetime bearing system.



5 QUIETER OPERATION

Electric Utilities across the country have recorded instances where home owners have registered complaints about "noisy meters" outside nurseries or bedrooms. Where noise constitutes a problem, it has become common practice to replace old-style, ball-bearing meters with General Electric magnetic-suspension meters. G-E meters operate more quietly because the disk floats free.



TEN MILLION METERS WITHOUT A SINGLE BEARING FAILURE PROVE THE SUPERIORITY OF GENERAL ELECTRIC'S MAGNETIC-SUSPENSION SYSTEM

For complete information on this exclusive meter line, contact your G-E apparatus salesman or write section 628-29, General Electric Company, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

AIEE-Georgia Tech relay conference

◆ A BALANCED PROGRAM of application information, new equipment developments, and special protection schemes, was presented to approximately 300 engineers attending the annual protective relaying conference sponsored jointly by the American Institute of Electrical Engineers and the Georgia Institute of Technology.

The two-day session was divided into four business sessions with H. P. Peters, of Georgia Tech, presiding over the opening session. Following sessions were conducted by James H. Williams, Tennessee Coal and Iron, Birmingham; J. C. Causey, Georgia Power Co., Atlanta; and George Miller, General Electric Co., Birmingham. General arrangements for the conference were under the direction of Richard Wiegand, director of short courses and conferences for Georgia Tech.

Static relays in spotlight

Of special interest were three talks presented at the opening session detailing the new trend toward static type relays utilizing semi-conductor components, the design features of the static relay line, and the application principles of the phase-comparison relay—first of the new static relay line introduced by General Electric Co.

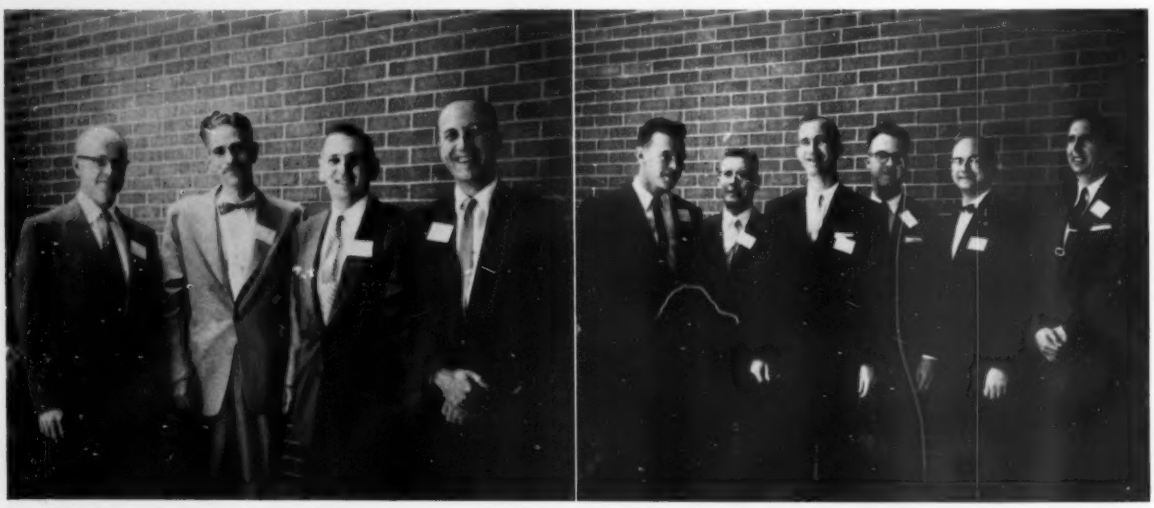
The discussion of the new trend was presented by D. B. Brandt, General Electric Co., Philadelphia. "Inherent limitations in electromechanical relays are raising barriers to the simultaneous achievement of the desired goals. Therefore we must turn to new techniques and utilize new components in new ways to achieve our goals. Static components have established sufficient evidence of reliability for consideration for use in protective relaying. They too, have other characteristics which are disadvantageous to protective relaying but can be overcome by proper design," Mr. Brandt reported.

"The use of static components in protective relays introduce new considerations in design. Not only must the components be reliable but the construction and assembly must be electrically and mechanically sound. To achieve this, the static components are carefully selected and used well within their ratings. The mounting board method of component mounting, soldering processes and plug-in sockets have been especially developed to insure mechanical and electrical reliability.

"Since the transistor can be damaged by excessive voltage surges, special precautions must be taken to provide surge protection. Consequently, surge protection is included on all a-c and d-c incoming connections.

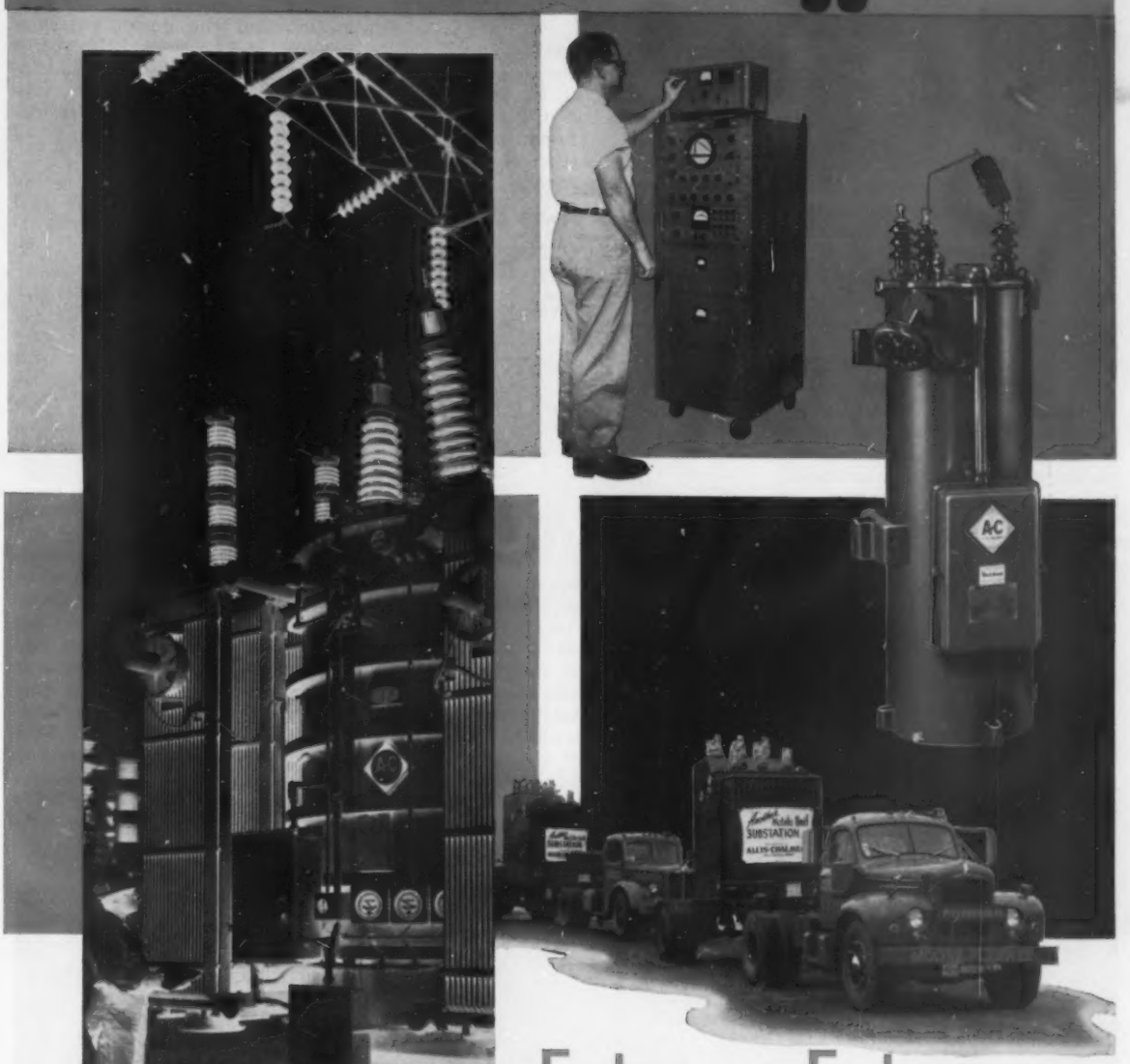
"A low voltage d-c power supply is required for transistor circuits. Consequently, if the station battery is used as the supply voltage, dropping resistors and a voltage regulating circuit are required to feed the transistor circuits with a constant d-c voltage.

"Although static relays employ a technology which may be new to both engineer and maintenance personnel, the block diagram functional approach will make them easy to understand and the modular plug-in construction easy to maintain.



Protective relaying experts who participated in the conference program were drawn from the electric utility industry, the electrical equipment manufacturers, and Georgia Tech. Left to right in left photo are T. A. Cramer, GE, Lynchburg, Va.; H. P. Peters, Ga. Tech; D. B. Brandt, GE, Philadelphia; and C. G. Dewey, GE, Philadelphia. Left to right in right photo, E. R. Blackwell and H. M. Hicks, Jr., both of Alabama Power, Birmingham; J. H. Williams, Tenn. Coal and Iron, Birmingham; J. L. Blackburn and W. E. Rich, both of Westinghouse, Newark, N. J., and R. S. Shipley, Federal Pacific Electric, Newark, N. J.

ALLIS-CHALMERS modern line for '59



Extras...Extras...

Read all about them

It's the extras that make the difference in the electrical equipment field today! There's much standardization today, but there's still room for the designer's genius. There's still room for features resulting from research or field experience.

ALLIS-CHALMERS A-C

While you're buying — update! And to update — look for the extras. They make the difference.

Some of the extras Allis-Chalmers offers are shown on the following pages. Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-5908-E

Complete line on way

"The phase-comparison relay," Mr. Brandt continued, "the first of the new line of static relays, in conjunction with its carrier pilot channel, detects line faults by comparing the phase position of currents entering and leaving the transmission line section. The three line currents are fed into a converter whose output is proportional to the negative-sequence line current. The converter output is fed to the fault detector and squaring amplifier. The squaring amplifier changes the sine wave input to a square wave signal and raises the energy level of the converter signal to key the carrier. The square wave output is also fed to the comparer. The comparer also receives a signal from the carrier-current receiver indicating phase position of the currents in the remote line terminal. The comparison of the phase position of the local and remote signals establishes tripping for internal faults and blocking for external faults. For applications where extreme sensitivity is required on three-phase faults, the phase comparison relay can be combined with the distance relays.

"The future promises a complete line of static relays—distance, differential, overcurrent and directional—designed for high-speed protection. Slow speed relays and other functions will appear in the pattern as the system requirements and economics dictate," Mr. Brandt concluded.

The opening session was concluded with discussions by T. A. Cramer and C. G. Dewey, both of General Electric Co., who presented additional details on the design and application of the static phase-comparison relay.

Relaying for power customers

The problem of proper relaying of industrial power customers who operate synchronous equipment was discussed by H. M. Hicks and E. R. Blackwell, both of Alabama Power Co., Birmingham. The speakers pointed out that such circumstances make it necessary to understand the customer's practices and operating methods, and in addition to the problems involving relay protection, the operating procedures must be worked out also.

In the case of industrial customers operating either synchronous motors or generating equipment in parallel with the power company system, the problem is how to protect the customer's synchronous equipment in the event a separation occurs between his system and the power company system.

The logical answer is the proper use of frequency and voltage relays to remove all synchronous equipment from any tie to the power company system. The feeders serving the synchronous motors must be opened and the interconnecting tie between customer generation and the power company system must be opened. Until this is accomplished, the power company must not attempt to restore service. The speakers then described a specific application of such a system.

An instructive discussion of the contrasts between English and American protective relaying practices was presented by R. S. Smithley, of Federal Pacific Electric Co. Economy of material and need for flexibility, Mr. Smithley told the group, has resulted in simple, reliable protection with far less standardization than we have in the United States. Some of their methods of protection, he said, may be worthy of further consideration because of their simplicity.

Differences in relay practice in England and the United States arise to a great extent from differences in design and characteristics of current transformers. There is little standardization of current transformers, and they are frequently small in size and limited in performance. Three secondary ratings are in use in England; namely, 0.5 ampere, 1.0 ampere, and 5 ampere. Generally, the 1.0 ampere rating is employed on all outdoor switchgear. Relays must have low burdens, and a variety of current ratings must be

Left to right in left photo are J. C. Causey and C. H. Griffin, both of Georgia Power, Atlanta; Jack Davey, Louisiana Power and Light, New Orleans; H. C. Stone, Line Material Inds., Milwaukee; and W. E. Rich, Westinghouse, Newark, N. J. In the right photo, left to right, are Harrison Taylor, C & D Battery Co., Conshohocken, Pa.; L. E. Owen, TVA, Chattanooga, Tenn.; George Miller, GE, Birmingham; and R. W. Ohnesorge, Florida Power and Light, Miami, Fla. The two-day program was divided into four sessions and covered a wide range of material on new developments and application of relay systems.

ALLIS-CHALMERS modern line for '59

Caliband control provides accurate settings quickly ... eliminates customer complaints

Now you can set or test voltage level and band width without changing customer voltage or interrupting regulated service. A twist of the *Caliband* control knob does it.

Caliband control demonstrator

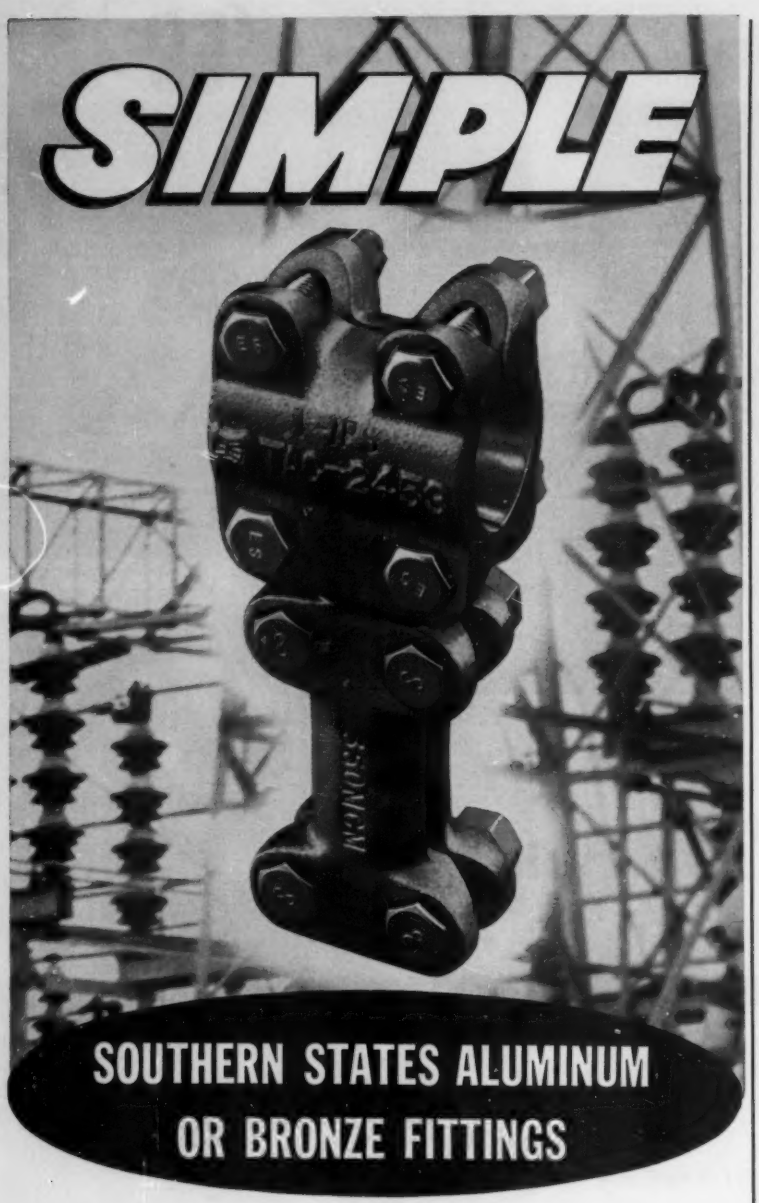
Ask an A-C engineer to demonstrate *Caliband* control at your desk with an actual unit in a portable kit. Contact your nearby A-C office for a demonstration, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

Caliband is an Allis-Chalmers trademark.

A-5904-E

ALLIS-CHALMERS

Originators of ⅝% step regulators



The clean, simple lines of Southern States connectors didn't just happen. The recessed hexagonal bolt heads, or proven alloys, didn't either. Nor did the resultant over-all strength, ruggedness, and durability of these high-quality fittings. All of those characteristics, which you look for in connectors, are the result of careful engineering, backed by more than 25 years experience in producing these products — from drawing board, to foundry, to you.

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

produced to operate with the different current transformer secondary ratings.

English relay applications

A typical example of the special design and application of current transformers and relays is found in the Merz-Price differential protection of generators. The current transformer characteristics have to be closely matched and the effects of their saturation on the stability of the relay during through faults, carefully studied. The Merz-Price relays and current transformers are designed for the particular application, and proved by quite expensive factory tests. No bias is employed, and the relay operates in the order of one cycle. The chief advantages lie in high speed operation and in simplicity of principles.

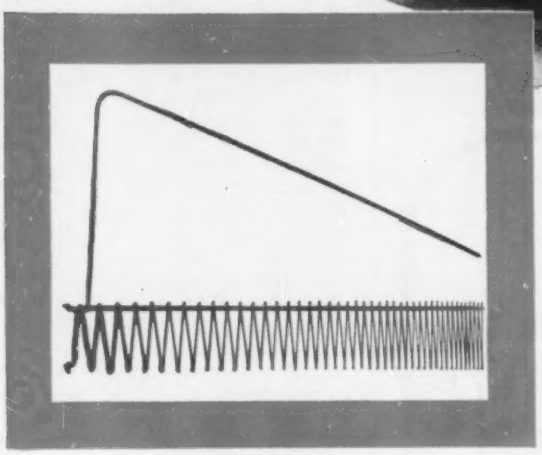
The current transformers must be carefully matched, and the required testing to prove this results in high cost. Nevertheless, this system is commonly used for the protection of generators, transformers, buses, reactors and even short feeders. High voltage feeders now employ phase comparison systems operating over carrier channels or telephone pilots.

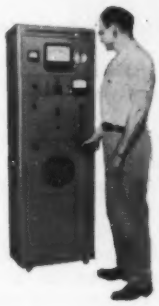
Background information on the application of static elements to protective relay design was presented by W. E. Rich and J. L. Blackburn, both of Westinghouse Electric Corp. The speakers pointed out that the basic parts needed for static protective relaying can be separated into four principal functions: (1) sensing or data processing; (2) timing; (3) amplifying and translation; and (4) power supply.

Static element functions

The sensing circuits will provide the basic "brain" or trouble-detection analogue function. It will compare and analyze the various trouble indicators such as current, voltage, frequency, phase angle, power, power direction, distance or impedance, either individually or in multiple combinations. An example of a key static device is the Zener diode used as a magnitude-sensing device. For those who may not be familiar with this device, it is merely a two-element semiconductor similar to the copper oxide or the selenium rectifier, except with a sharp back voltage breakdown and with the ability to recover after carrying a large amount of current. The sensing circuits for comparing ratios of two

ALLIS-CHALMERS modern line for '59





Insulation strength assured

Automatic fault detector oversees impulse tests of Allis-Chalmers distribution transformers

Even the smallest fault triggers a flashing red light and an alarm bell. Thus the new automatic fault detector eliminates human error in impulse testing. What better assurance that overall insulation strength meets all standards — that insulation will withstand severe lightning and surge conditions!

Every Allis-Chalmers distribution transformer, from 5 to 500 kva, is impulse tested on the production line. The record of operating reliability proves the wisdom of this policy. Call your A-C man for details, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Plan to stay ahead... MODERNIZE!

ALLIS-CHALMERS

A-5906

CHANCE
K&T Fuse Links
can be used with any distribution cutout on the market

Quality control tests make certain that Chance Fuse Links meet standard requirements.

Precision-made to EEI-NEMA Interchangeability Standards

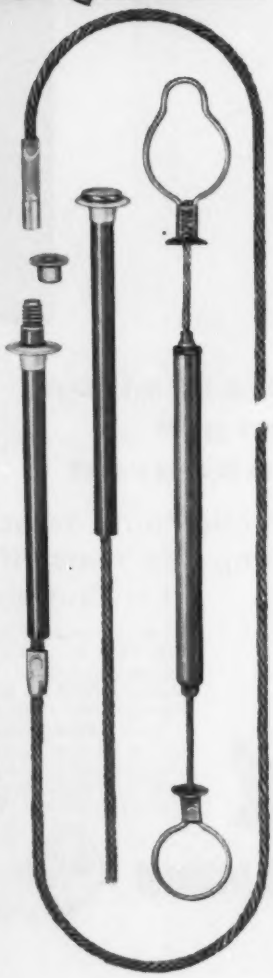
Chance K (fast) or T (slow) fuse links are available in three styles—Universal Buttonhead, Open-Link, and Universal style with removable buttonheads and cable adapters.

The fusible elements of these fast or slow fuse links have the consistent melting characteristics needed to give dependable performance in any distribution cutout at all values of fault current. Each individual strand of the copper cable leads is lead-coated for maximum resistance to corrosion.

Write for "Fuse Links and How to Use Them," a free manual on fuse link application and coordination.

Packaged for *EASY* removal

A slight twist separates a single link container from the 5 unit pack. Perforated end on single container allows link to be taken out easily — even with lineman's gloved hands. Type and rating are clearly marked on both ends of each box.



A. B. CHANCE CO.
CENTRALIA, MISSOURI
A. B. Chance Co. of Canada, Ltd., Toronto

CF59-18

qualities, for phase-angle detections and other comparisons are somewhat more complex.

The timing functions may be needed to slow up the sensing or amplifier circuits in order to override the tolerable power system and instrument transformer transients. Sometimes they will be required for time-delay discrimination of breaker operation. The R-C circuit has been used successfully in this area.

The amplifying and translating units necessary to control the breakers can be designed with transistors, four-layer diodes, power transistor, or controlled rectifiers. These can eliminate the slave relay but the main consideration is one of economics.

The power supply can come from the a-c line or from a battery supply, or both. The trip circuits for the breakers, in general, are batteries which have proved reliability. Therefore, it is logical to assume that this source will be used. The components for the amplifier are now available for controlling breakers without interposing slave relays. The economical solution to this, however, is still troubling the relay designers. The 24-volt systems offer the most reasonable solution yet. Other shortcomings familiar to utility engineers have all but made this level of control voltage extinct. The 48-volt system is not unreasonable and may be the logical compromise. The 125-volt system is by far the most popular at present. The problem of high voltages in this level, strains the economy of the present components. This, however, may just be a matter of time, they reported.

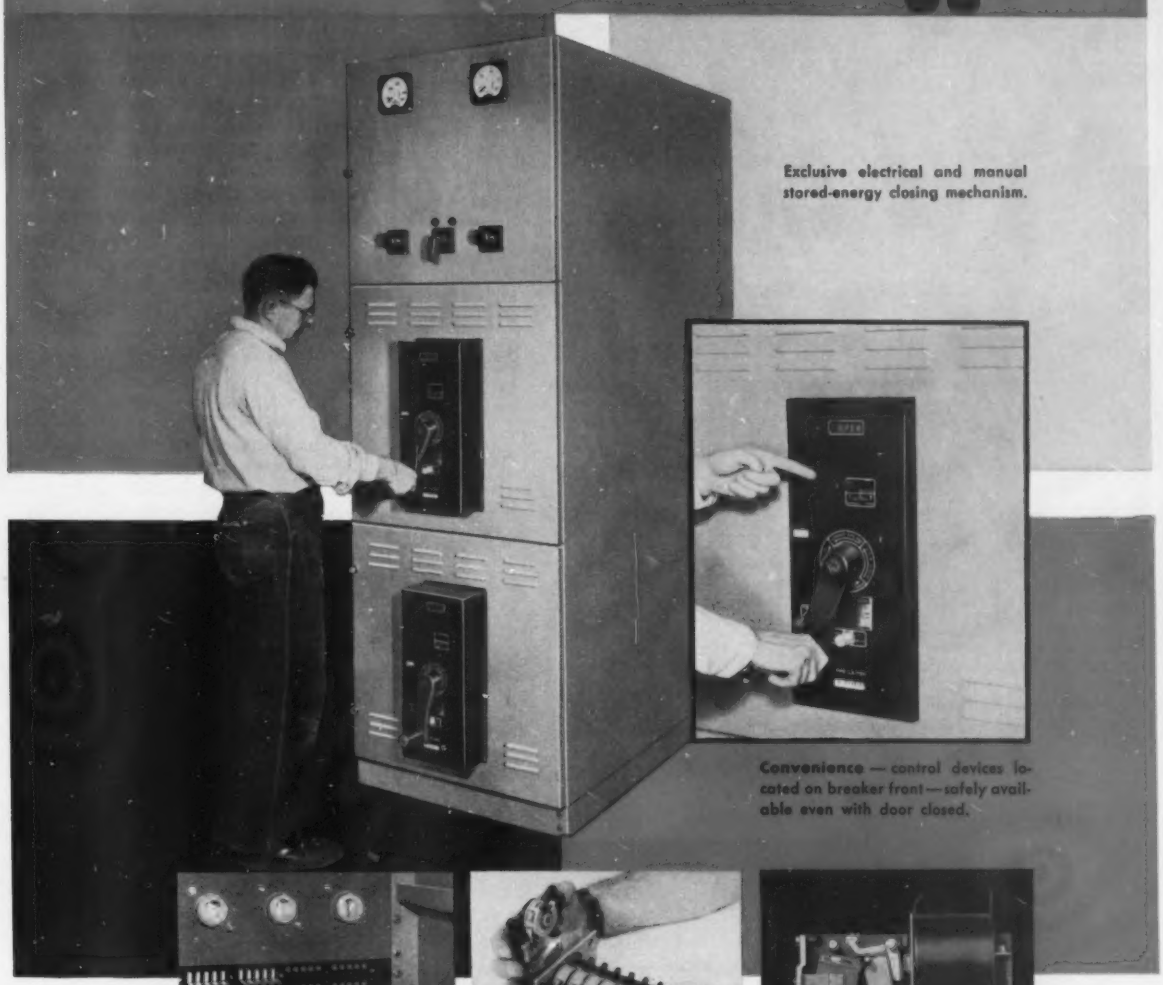
Static relay evaluation

After discussing some of the general problems that enter into the design of static protective relays, the speakers presented an evaluation of statics in this field, taking five basic factors into account:

(1) As to reliability, statics appear to offer advantages, but much is still unknown as to the long-time life of many of the new devices.

(2) Selectivity—Statics do not appear to offer any appreciable advantages here unless some entirely new means of trouble locations are found. However, some advantages of statics such as instantaneous reset and low burden may help to reduce unanticipated relay operation.

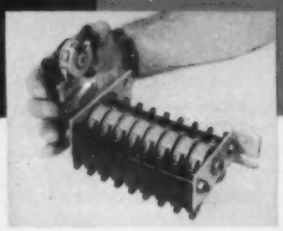
ALLIS-CHALMERS modern line for '59



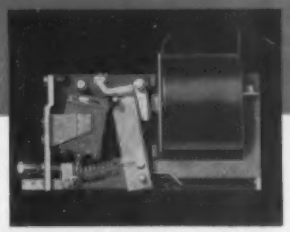
Exclusive electrical and manual stored-energy closing mechanism.

Convenience — control devices located on breaker front — safely available even with door closed.

Safety—*(a)* interlock prevents movement of closed breaker; *(b)* latch prevents rocking past disconnect position.



Flexibility—each stage of auxiliary switch assembly is individually adjustable without disassembly.



Accuracy — direct acting series-trip device is set easily, using calibration scale and adjusting knob.

Plus value in every detail

Allis-Chalmers all-new 600-volt metal-enclosed switchgear for 75,000-ampere interrupting service

Just a few of the operating . . . safety . . . and application features of A-C's new design are shown. There are many other features that will interest you, such as unitized construction, the use of polyester glass insulation, and spring-held dust seals.

Get the details! Contact your nearby A-C office or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Plan to stay ahead... MODERNIZE!

A-1038-E

ALLIS-CHALMERS

SHAWMUT
SILVER PLATED FUSES
. . . at no extra cost
SILVER-PLATED for Cooler Operation
Gives positive protection against non-conducting, heat-producing copper oxide. Prevents power waste through watt loss. Reduces maintenance. Keeps switchgear, busways, switches, panel boards, motor starters and other apparatus cool and safe. SAY "SHAWMUT" for your own Protection.
Specify SHAWMUT. Get SHAWMUT — The Silver-Plated Line. Amp-trap . One-Time . Trionic . t-d Renewables. All have silver-plated contacts . . . at no extra cost. Only Shawmut has them. Call your distributor now.
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Subsidiary of I-T-E CIRCUIT BREAKER CO., Philadelphia, Pennsylvania
Est. 1893
Amp-trap
Tri-onic
t-d
C-O-T
TRIONIC
O-T

(3) Speed—Here statics offer high potentiality of faster operating relays. The major obstacle to faster operating relays often is not in design as such but in the power system and instrument transformers with their transients. Electromechanical units have built-in inertia which can be used to advantage to override transients. Static relays will require additional equipment and circuitry with attendant cost and complexity to overlook tolerable transients. Static techniques are highly effective in filtering transients, but time delay is added so that there may not be an appreciable over-all advantage to be gained in this area.

(4) Simplicity—Individual units in statics will be more complex in circuitry and contain more individual electrical components compared with electromechanical coils and contacts. At first, statics may appear more complex, but familiarity and improved techniques will show advantages over electromechanics.

(5) Economy—First cost generally will be higher for static relays than for electromechanical relays. This will be true, particularly in the beginning, with potential of ultimately being the same or lower. Installation cost probably will be about the same. The major advantage anticipated by everyone is less maintenance cost.

Cable carrier channels

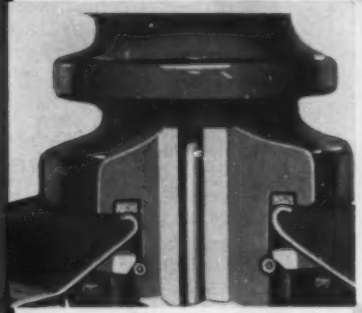
A technical study by C. W. Cogburn, of Florida Power and Light Co., Miami, investigated the application of carrier current channels on high voltage power cables. The conclusions reached by Mr. Cogburn were that field measurements can coincide exactly with transmission line theory, but that the lack of quantitative information on characteristic data at carrier current frequencies on power cables of all types makes further measurement tests advisable.

The opening session of the second day of the conference featured a discussion of unusual relaying applications presented by C. H. Griffin, of Georgia Power Co., Atlanta. These unusual methods of meeting some usual and unusual problems were obtained from various electric operating companies throughout the Southeast. He was followed on the program by G. J. Marieni and W. E. Rich, both of Westinghouse Electric Corp., who discussed the increased versatility of the overcurrent relay.

THESE SUPERIOR MOLONEY FEATURES ASSURE DEPENDABLE SERVICE

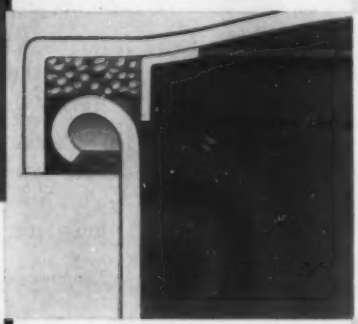
All bushings are made of high strength, wet-process, porcelain and are internally clamped using one piece Almag clamps. The high voltage bushings have a configuration design to obtain liberal creepage without excessive height and to assure high impact strength. Each gasket is made of reusable cork-neoprene and is retained.

Sidewall bushings have the hardware keyed to the porcelain and the porcelain keyed to the tankwall, thereby preventing rotation of the bushing or any of its parts. Sidewall mounted high voltage bushings are equipped with a special cap for clamping the conductor in place quickly and safely without the use of tools.



Cover mounted bushings are mounted on a smooth flange raised above the cover. This smooth rounded flange and the shape of the porcelain positively prevents the entrance of moisture. The contour of the flange eliminates corona at this point. Protective caps are provided for all cover mounted high voltage bushings.

Connectors are electro-tin coated and large enough to accommodate either the copper conductors specified by EEI-NEMA Standards or the ACSR equivalent. The large contact surface and a double-coil spring-type washer reduces conductor cold flow.



The tank and cover are die-formed assuring consistently accurate fit. The cover overhangs the tankwall and is dome shaped to shed moisture. The combination of a rolled top rim, cover overhang, cork-neoprene gasket and the gasket retainer positively seals the tank from moisture.

The base is welded to the tank wall. Then a sealing mastic is applied and the tank wall is rolled under the base flange to provide a triple thickness of metal. The tank and cover are painted by a hot-spray process and each coat is baked to form an extremely durable finish.

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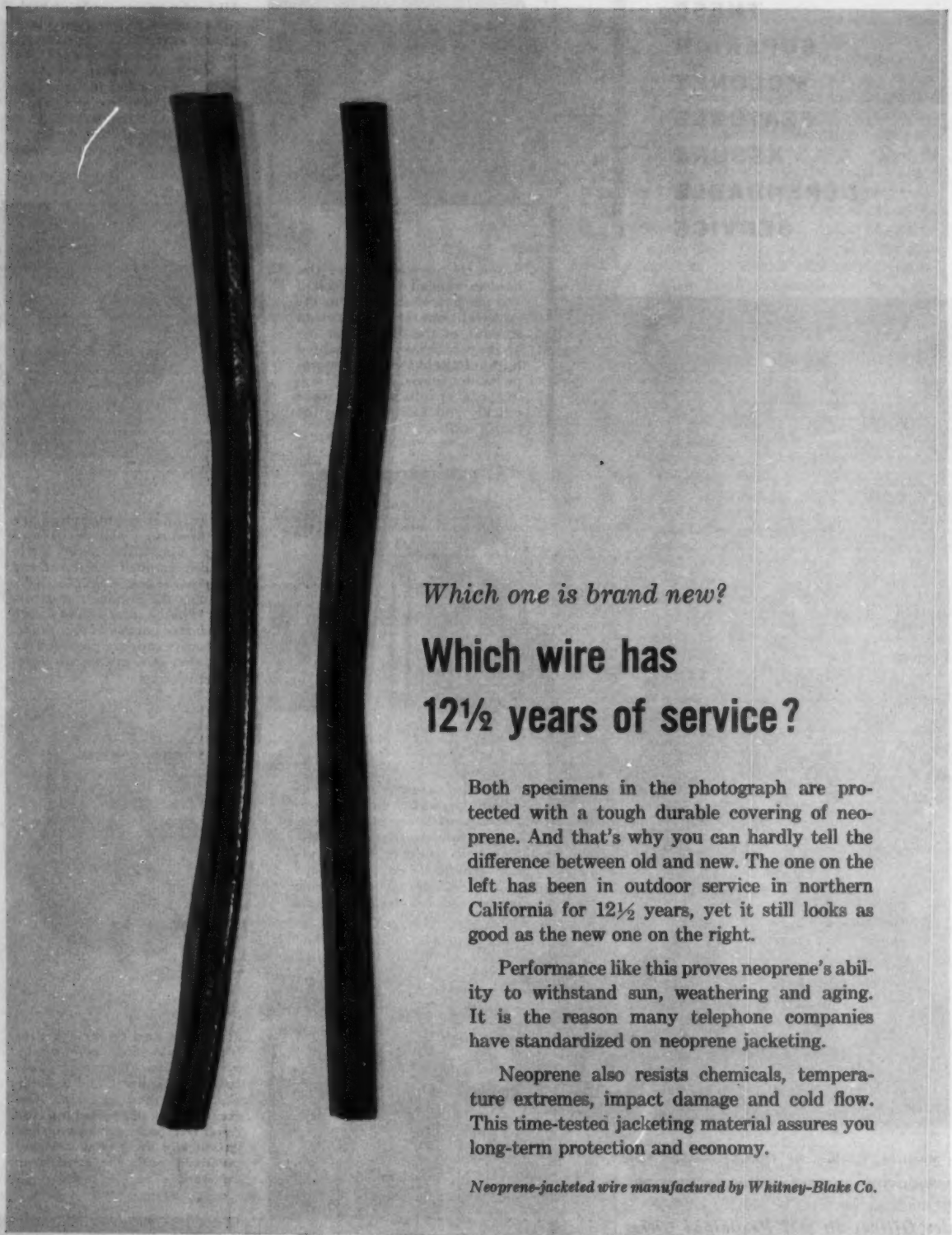

Which one is brand new?

Which wire has 12½ years of service?

Both specimens in the photograph are protected with a tough durable covering of neoprene. And that's why you can hardly tell the difference between old and new. The one on the left has been in outdoor service in northern California for 12½ years, yet it still looks as good as the new one on the right.

Performance like this proves neoprene's ability to withstand sun, weathering and aging. It is the reason many telephone companies have standardized on neoprene jacketing.

Neoprene also resists chemicals, temperature extremes, impact damage and cold flow. This time-tested jacketing material assures you long-term protection and economy.

Neoprene-jacketed wire manufactured by Whitney-Blake Co.

For more information about neoprene write to: E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. ES-7, Wilmington 98, Del.

DU PONT

SYNTHETIC RUBBER

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Better Things for Better Living . . . *through Chemistry*

A wide range of applications of overcurrent relays were discussed, including motors, feeder phase protection, coordination with series trip air circuit breakers, and rectifier protection. The speakers explained that the prime characteristic of the induction-type, time-overcurrent relay is its time-current curve. Time and current are used to discriminate between faults in order to obtain coordination of the system breakers and to obtain supervision of varied control functions. Economical advantages and better protection can be obtained by the use of supplemental devices in conjunction with the induction time-overcurrent relay. The knowledge of what is available and how the various characteristics can be combined could lead to better solutions to existing and future relaying problems. The further exploitation of the time-overcurrent relay is limited only by our needs and imagination.

Protecting tap load stations

A method of providing protection for tap load stations by using grounding switches was described by R. W. Ohnesorge, of Florida Power and Light Co., Miami.

"The Florida Power and Light Company uses many tapped load substations in order to feed its distribution," Mr. Ohnesorge told the conference. "About one and one-half years ago, three tapped substations experienced bus side bushing failures on the distribution breakers. The faults eventually cleared themselves but not until the power transformers, bus work, and circuit breakers were severely damaged. This series of substation fires occurred in less than a three month period. Coincidental as it was, the damage pointed out the inadequate protection we were giving our tapped substations."

After describing a typical tapped load substation and the line constants involved, Mr. Ohnesorge explained that it was obvious that some means of disconnecting the transformer from its source was necessary.

"The ideal solution from a protection viewpoint would be a high side breaker," he said. "This arrangement was, of course, considered to be too expensive, and more economical methods were immediately considered. The first solution to be considered was high side fuses and these were actually applied in a few cases.

"This problem of applying high side fuses meets with the following considerations: If fuses are to be effective, it is necessary for them to coordinate with the feeder breakers, the safe heating curve of the transformer, and the transmission line breaker relays. High side fuses should also be relatively safe from lightning and various system surges.

"Is was found that it would be possible for a phase to ground fault on the low side of the transformer bank to result in only one high side fuse blowing. This situation would apply full voltage to one of the secondary phases and partial voltage on the others. The same condition could occur if a phase to phase fault persisted on the low side. The unbalance in either case could result in single phasing the load while a dangerous and comparatively slow burning fault would continue in the substation.

"In general, it was finally concluded that although fair protection was provided by high side fuses, it was by no means complete. Complete protection would be very difficult and often impossible with high side fuses.

"Since high side breakers and fuses were shelved as a means for protecting these stations, there remained another alternative. This alternative was to trip the remote high line circuit breakers to de-energize the line. A transfer trip scheme by pilot wires or by carrier was considered in order to trip the supply breakers, but this approach was discarded since more than one station is usually tapped from a line section and this introduces the problem of monitoring many transfer trip channels, and because cost and maintenance factors were not favorable.

"Finally the ground switch was considered. At first, the idea of deliberately throwing a ground on a transmission line seemed impractical. Upon checking on past relay experience, however, the reliability of this sort of scheme was proved. Further computations also proved the economics of the scheme, and it was adopted.

"The specifications call for a single-phase ground switch, spring loaded, which would operate within ten to fifteen cycles. This figure has been reached successfully. For a bushing failure, it has been estimated that a fault will be cleared within twenty cycles by the use of this scheme, assuming 5 cycle breakers on the transmission line section. Within forty-one cycles from the time of initial

YOU CAN GIVE BETTER SERVICE CONTINUITY WITH

SAFER

WESTINGHOUSE 1¼%-STEP REGULATORS

Do you always know . . . for sure . . . the position of the tap changers in your regulators? You can, with the Westinghouse position indicator which gears down from a higher speed cable drive. This eliminates drive cable error, prevents danger of bypassing off-neutral position. Dial can easily be read from the ground.

In addition, where load range selection is used, internal indicator detents prevent movement of limit switches from set position to provide positive range limits.

Here is more evidence that Westinghouse feeder voltage regulators are safer to operate, assurance that you can offer better service . . . all the time. J-70901

Westinghouse URF and URL single-phase feeder voltage regulators

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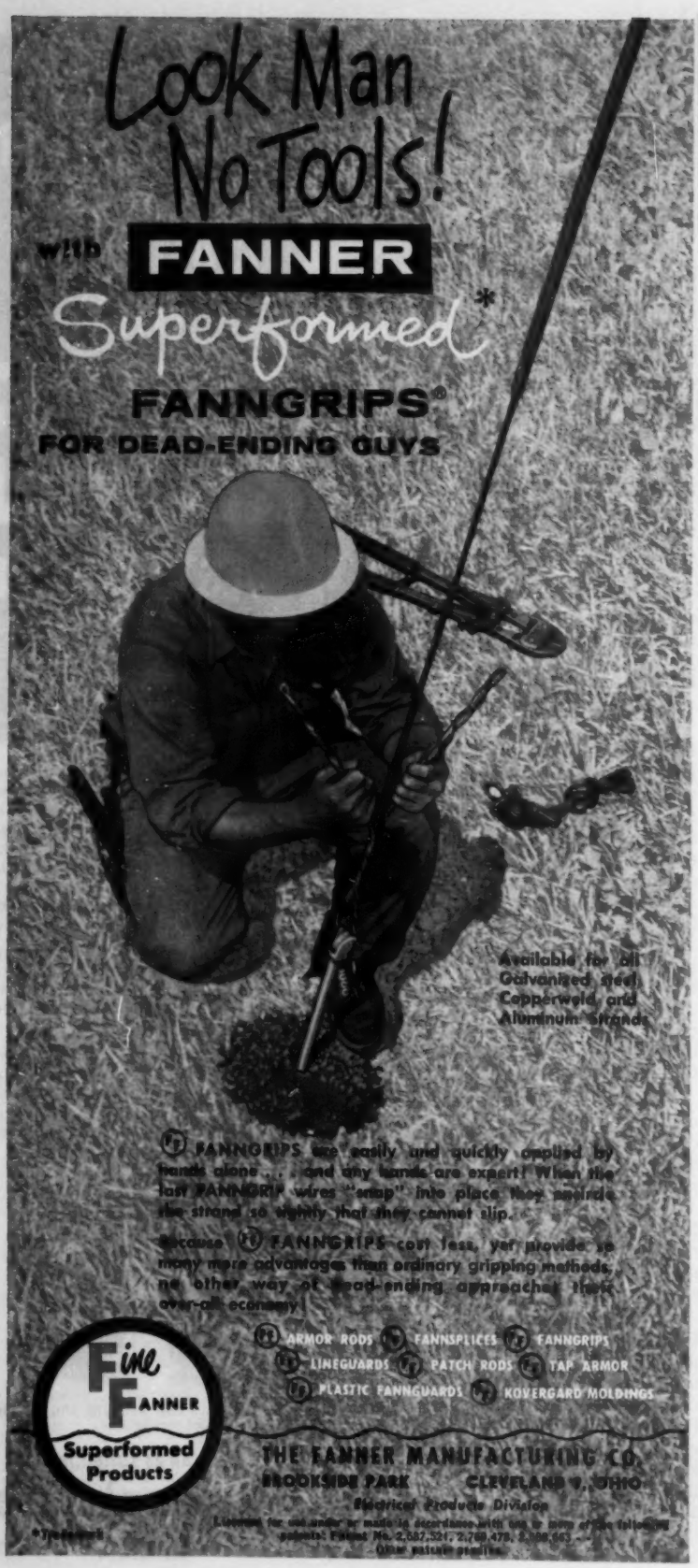
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FOR DEAD-ENDING GUYS
Available for all Galvanized steel, Copperweld and Aluminum Strands
FANNGRIPS are easily and quickly applied by hands alone . . . and any hands are expert! When the last FANNGRIP wires "snap" into place they encircle the strand so tightly that they cannot slip.
Because FANNGRIPS cost less, yet provide so many more advantages than ordinary gripping methods, no other way of dead-ending approaches their over-all economy!
ARMOR RODS FANNSPLICES FANNGRIPS
LINEGUARDS PATCH RODS TAP ARMOR
PLASTIC FANNGUARDS KOVERGARD MOLDINGS
Fine Fanner
Superformed Products
THE FANNER MANUFACTURING CO.
BROOKSIDE PARK CLEVELAND 9, OHIO
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Licensed for use under or made in accordance with one or more of the following patents: Patent No. 2,582,524; 2,768,478; 2,888,663
Other patents pending

fault, the transmission breakers will have reclosed and locked out.

"In order to minimize the transmission line outage, a motor-operated airbreak switch is used to disconnect the high side of the transformer bank. This switch is comparatively slow with respect to the ground switch and will completely disconnect the bank in approximately five seconds. By this time, the transmission line breakers will have relayed, reclosed, and relayed and the line would be completely dead. After fifteen seconds, the dispatcher would reclose the transmission line breakers in order to pick up the other transformer banks on the line and to complete the transmission system.

"The protection at the substation was designed on a unit basis. Each three phase transformer has its own ground switch, motor-operated airbreak, and cabinet of protective relays. This outdoor cabinet is located near the transformer it protects.

"This ground switch protection is planned for a total of about 150 substations. At present, about fifty per cent of these are in service.

"To date, we have had five correct actions of this ground switch. In two cases, bus side bushing failure initiated the action. In another, a wire belt had been thrown into the distribution operating bus. A power transformer developed a turn to turn fault at another station. In all cases, the damage was minimized by the action of the ground switch.

"In a few cases, the aluminum ground switch blade had to be replaced, but in the majority of cases, the damage to this switch was minor and it could be returned to service immediately. Blades for replacement ground switches will be carried in stores.

"In the short period of time this scheme has been in service, the protection has proved its worth and will probably stay in service for some time to come. It is now considered to be standard installation for tapped substations."

A comprehensive discussion of capacitor protective schemes was presented by Harold C. Stone, of Line Material Industries, Milwaukee. He pointed out that the smaller capacitor banks, such as pole mounted installations up to 1200 kilovar, are generally protected by group fuses. He defined group fusing as the case where a fuse cutout is used to protect more than one capacitor unit such as a

(Continued on page 122)

New utility equipment

"Perma-Gold" transformers available on request

THE NEW Kuhlman "Perma-Gold" transformers are now available to utilities for service to Medallion Homes in their distribution systems.

The "Perma-Gold" transformer,

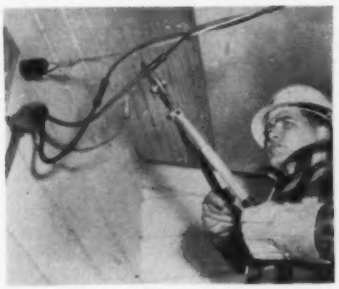
which matches the color of the gold plaque displayed on all-electric Medallion Homes, serves as an additional prestige symbol of all-electric living.

Kuhlman Electric Co., Birmingham, Mich., will furnish its distribution transformer in the "Perma-Gold" finish on request.

Write U-701 on reply card, page 93.

Pre-insulated connector eliminates taping

INSTALLING and insulating service entrance phase-wire connections are combined into a single, tool-controlled operation with pre-insulated "Insulink" compression connectors de-



veloped by Burndy Corp., Norwalk, Conn. Requiring no taping and easily installed by an unassisted operator with standard crimping tools, the new connectors can be used to splice aluminum and copper cables ranging from #10 str through 1/0 and ACSR from #6 through #2.

An aluminum sleeve, of the "massive anode" design to eliminate conductor erosion due to galvanic action, is encased in an insulating nylon jacket with a polyethylene cap on each end. Installation tools crimp right through the jacket without piercing it. The end caps not only grip the cable insulation securely to free both of the installer's hands for crimping but also protect the completed splice against moisture.

Jackets are color-coded to show the range of cable sizes accommodated and have guide lines to show how far back to strip cable insulation and where to crimp. Saving time and eliminating tape permit significant economies in the installed cost of service entrance connections.

Write U-702 on reply card, page 93.

New expansion connectors, custom-built, flexible

ANDERSON Electric Corp., 700 N. 44th St., Birmingham, Ala., announces a new flexible expansion connector designed to connect 16-inch OD aluminum tubing. Anderson cus-

tom-built the connectors to specifications drawn by EBASCO Services, Inc. These will be installed by EBASCO in the main generator leads of Houston Lighting and Power Company's 220,000 kw Unit No. 3 at Sam Bertron Steam Electric Station scheduled for completion this year.

Each connector consists of 16 laminated aluminum shunts. The ends of each shunt are fused together by the Heli-Arc welding process to insure even current distribution in all leaves of the shunts. The shunts are bolted at both ends to two cast aluminum alloy plugs which have been inserted into the 16-inch tubing and welded in place. Each laminated shunt measures 19½ inches long and is com-

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RUGGED

WESTINGHOUSE 1¼%-STEP REGULATORS

Are your regulators rugged enough to meet *all* the conditions they're likely to encounter over a long period of service? Well, here is an exclusive Westinghouse idea that greatly lengthens contact life. Westinghouse regulator contacts are designed to give maximum contact life under all conditions. Higher current ratings make use of a unique magnetic effect to multiply contact pressures under short circuits to prevent burning. Normal contact pressures are maintained under usual operating conditions to prevent galling.

With Westinghouse voltage regulators, you get this and many other exclusive benefits that mean longer, more dependable service. For full details, call your Westinghouse representative. J-70922

Westinghouse URF and URL single-phase feeder voltage regulators

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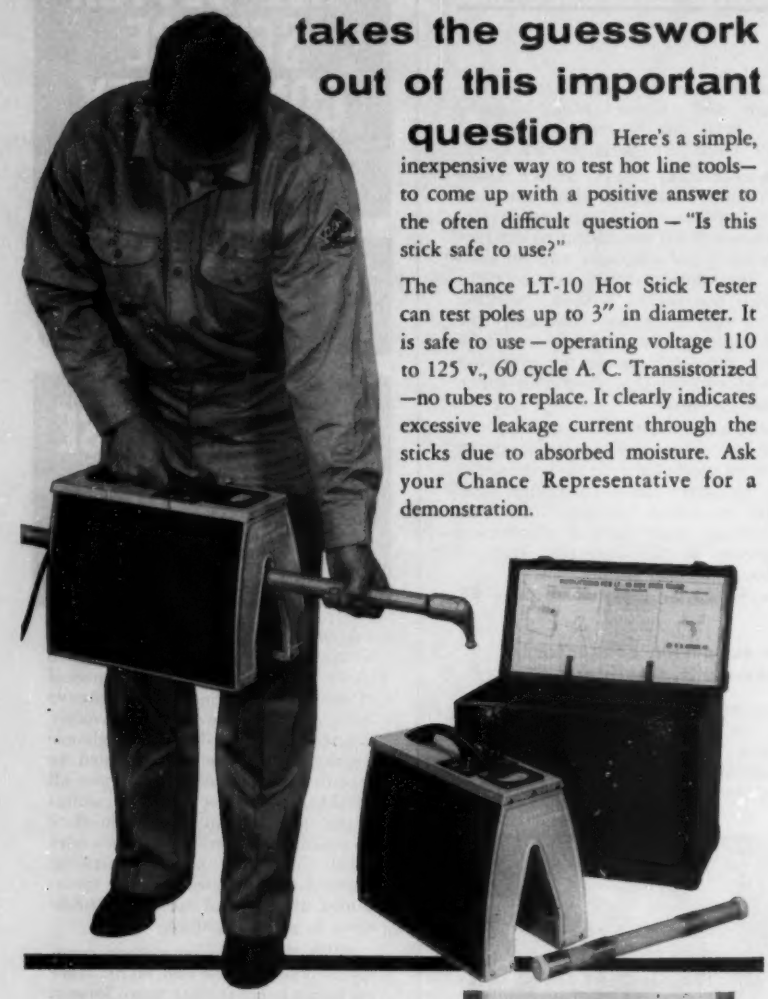
ARE YOUR HOT STICKS SAFE?

Chance Portable Hot Stick Tester takes the guesswork out of this important question

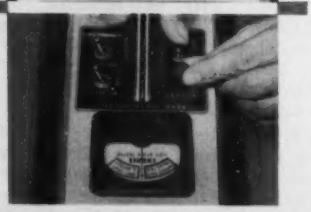
Here's a simple, inexpensive way to test hot line tools—to come up with a positive answer to the often difficult question—"Is this stick safe to use?"

The Chance LT-10 Hot Stick Tester can test poles up to 3" in diameter. It is safe to use—operating voltage 110 to 125 v., 60 cycle A. C. Transistorized—no tubes to replace. It clearly indicates excessive leakage current through the sticks due to absorbed moisture. Ask your Chance Representative for a demonstration.



EASY TO OPERATE. A simple single dial shows whether the tool is safe to use or whether the tool should be dried and re-tested. A number of readings along the pole test every foot for safety.

EASY TO CALIBRATE. You can always be sure that the tester is accurately calibrated. Just press the "PUSH TO CALIBRATE" button and turn "ADJUST" knob until needle is centered on dial. A calibration standard is furnished with the unit for positive double-checking.



ABC Industries

A. B. CHANCE CO.

CENTRALIA, MISSOURI

A. B. Chance Co. of Canada, Ltd., Toronto

CH59-16

posed of 27 aluminum strips 1/32 of an inch thick.

Assembled, each of the flexible connectors weighs 147 pounds and contains 702-feet of aluminum strip.

Write U-703 on reply card, page 93.

Lighting control designed for pole-top installations

A SPECIAL photoelectric lighting control for use with large mounting bases has been announced by the Fisher-Pierce Co., 60 Pearl St., So. Braintree 85, Mass. Model 6607A is

designed to fit mounting bases up to 3⅝ inches in diameter, such as ornamental pole tops and certain luminaires.

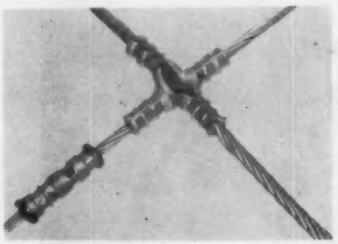
Model 6607A and other units in the tubeless F-P 6600A series all conform to the new EEI-NEMA standard for twistlock controls. Fisher-Pierce also offers a complete line of adaptors, mounting brackets and mounting taps designed to adapt standard F-P units for mounting on slip-fitter or pole top.

Write U-704 on reply card, page 93.

Cast-aluminum connector available in six sizes

COMPRESSION X-Taps, manufactured by the A. B. Chance Co., Centralia, Mo., are designed for mid-span tapping where opposite right-angle service taps are required. By leaving the end of a single tap projecting from the X-Tap, an opposide-side tap can be easily made at some later time with a compression sleeve.

Applied with any compression tool



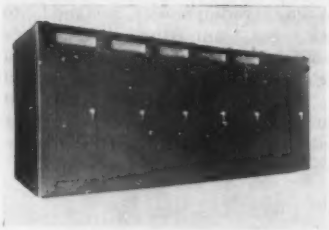
that has a ⅝-inch diameter groove, X-Taps are available in six sizes. They give a main-line conductor range of 4 ACSR or 2 solid through 2 ACSR; a tap-line range of 6 ACSR

or 4 solid through 2 ACSR. All sizes meet NEMA power-connector requirements and EEI heat-cycling requirements for light-duty connectors.

The sleeves of this cast-aluminum connector are filled with electrical contact aid. Each connector is packaged in a transparent plastic bag to protect the contact aid. Color-coded tapes show wire sizes in large print.
Write U-705 on reply card, page 93.

Capacitor equipments use 50-kvar capacitor units

LARGE METAL-ENCLOSED capacitor equipments that use 50-kvar capacitor units and are designed for distribution substations are now available



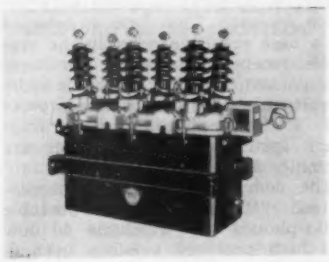
from the Westinghouse Electric Corp., P. O. Box 2278, Pittsburgh 30, Pa.

Designated "Mod-ul-var 50," these capacitor equipments use 50 kvar capacitor units that are assembled into 1200-kvar modules. Field installation (outdoor or indoor) involves only bolting the required number of modules together. A separate bus entrance or circuit breaker compartment is merely bolted at one end to complete installation.

The "Mod-ul-var 50" capacitor equipments are available from 2400 to 13,800 volts (wye connected) and in bank sizes from 1200 to 6000 kvar.
Write U-706 on reply card, page 93.

Three-phase sectionalizer added to switchgear line

A NEW three-phase sectionalizer, designated GN3, providing economical three-phase lockout with high continuous-current and short-time current ratings is the latest addition



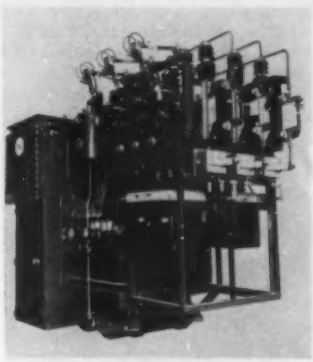
to the Kyle line of switchgear available from Line Material Industries, Milwaukee 1, Wis.

The sectionalizer has load current ratings of 5, 10, 15, 25, 35, 50, 70, 100, 140, 160, 185, and 200 amperes at 2.4 through 14.4 kv. Maximum short-time current ratings are 1800 amperes for ten seconds, 6000 amperes for one second, and 9000 amperes for momentary and latching asymmetrical current.

The GN3 sectionalizer incorporates single-phase counting with positive interphase linkage for three-phase lockout in a single tank. By setting the lockout adjustment pins, the sectionalizer can be adjusted to lockout after one, two, or three consecutive operations of the backup recloser.
Write U-707 on reply card, page 93.

Substation available in six standard arrangements

SINCE INTRODUCING their first integrated substation in March, 1958 Moloney Electric Co., St. Louis 20, Mo., has continued development work on this type of unit and they now offer the following six standard arrangements of integrated substation: 1. Single-circuit with bus disconnect, 2. Single-circuit with bus and load disconnects, 3. Single-circuit with bus and load disconnects and by-pass switch, 4. Double-circuit with bus disconnects, 5. Double-circuit



with bus and load disconnects, 6. Double-circuit with bus and load disconnects and by-pass switch, these alternative arrangements offer wide flexibility in meeting both current and future service requirements of outlying areas as one arrangement is easily converted to another by adding switches and/or a recloser.
Write U-708 on reply card, page 93.

Distribution transformers feature new type terminal

DISTRIBUTION transformers manufactured by Central Transformer Corp., Pine Bluff, Ark., feature a new type of terminal designed to solve aluminum clamping problems.

The new terminal, called "Uni-Grip," features a specially-designed washer which, it is claimed, maintains pressure adequate to compen-

YOU CAN GIVE BETTER SERVICE CONTINUITY WITH

CONVENIENT

WESTINGHOUSE 1¼%-STEP REGULATORS

In addition to dependable operation, convenience and versatility are reasons that make regulators more valuable to you. With pad- or platform-mounted URF units, for example, Westinghouse supplies a hand crank for manual operation of the tap changer. Positions may be changed with the regulator de-energized or motor circuit inoperative.

For data on this and many other exclusive convenience features of Westinghouse regulators, get in touch with your Westinghouse representative. J-70023

Westinghouse URF and URL single-phase feeder voltage regulators

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sate for aluminum conductor "cold flow." The special washer is constructed of high carbon steel, zinc-plated with chromate conversion.

Another feature of the "Uni-Grip" terminal is flowed tin plating on bronze body and eye-bolt which assures compatability, corrosion-wise, with either aluminum or copper conductor.

The "Uni-Grip" terminal was designed by Anderson Electric Corp., Birmingham, Ala., in cooperation with staff engineers at Central Transformer Corp.

Write U-709 on reply card, page 93.

Portable two-way radiophone eliminates interference

A NEW portable tone coded squelch two-way radiophone, designed to block out annoying interference caused by other radio systems on a user's channel, has been introduced by Motorola Communications and Electronics, Inc., 4501 W. Augusta Blvd., Chicago 51, Ill. Called "Private Line" radio, the new "Handie Talkie"

two-way unit provides the same protection from local and long-range skip interference as the company's "Private Line" mobile and base station equipment.

Technically, "Private Line" radio works on a tone coded squelch principle. The transmitters in a system generate an inaudible coded tone which is transmitted along with the voice message. This tone is detected by a tone sensitive relay in the system's receivers. Incoming messages are blocked from the receiver's audio circuit unless the coded tone is present. Consequently, messages from other systems on the channel are normally not heard.

The compact, extensively transistorized "Handie Talkie" portable radio-phones are available in low and high powered versions in both the 25-50 mc and the 144-174 mc frequency bands. The equipment can be operated from long lived dry cell or rechargeable nickel cadmium interchangeable battery power packs.

The units vary in weight from 7 to 18 pounds, depending on the power of the unit and the type of its battery supply.
Write U-710 on reply card, page 93.

Redesigned Faultfinder lighter in weight

A NEWLY DESIGNED Faultfinder is now being offered by Parr Manufacturing Corp., 44 Austin St., Newark, N.J. Through the use of new, lightweight materials, the weight of the Faultfinder has been lowered from 27 pounds to 18 pounds. As part of the new design, double ear phones, covered with foam rubber, are now included as standard equipment.

The Brunt Faultfinder is a combination ground detector and fault locator, and it locates accidental grounds on power systems, both a-c and d-c, up to 600 volts, while the system is energized. Imposing only

two amperes on the circuit, it cannot damage equipment on the line.

Since, in using the Brunt Faultfinder it is unnecessary to close down power supply, costly production costs are eliminated. The Faultfinder, easily operated by one man, is convenient in tracing pole line signals without the necessity for climbing, and in locating underground cable and pipes.
Write U-711 on reply card, page 93.

One-man operated derrick safe and easily controlled

STAHL METAL Products, Inc., 4750 W. 160th St., Cleveland 35, Ohio, has just introduced a new hydraulic derrick for utility line trucks. Three models of the Stahl derrick are available, the PH4 for handling poles up to 40 feet long, the PH55 for 55-foot poles, and the Model PH70 for poles to 70 feet.

The Stahl hydraulic derrick folds flat on the truck roof adding only 13 inches to the truck height. Folded, it does not interfere with "head room" in the truck.

Built with a huge safety margin

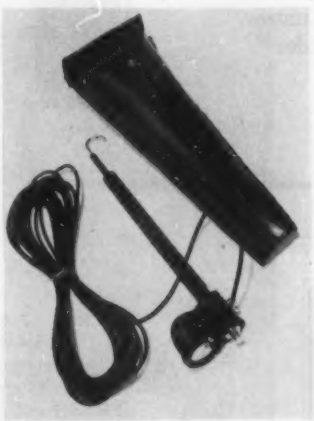
at all points, the Stahl hydraulic derrick is actuated by pairs of powerful hydraulic cylinders which are always pulling. Booms are of high-tensile steel.

Available with hydraulic jacks and with stiff leg, the derrick is one-man operated and easily controlled.
Write U-712 on reply card, page 93.

High line safety voltmeter, light, compact, saves time

THE NEW HIGH line safety voltmeter from Western Electro-Mechanical Co., Inc., 300 Broadway, Oakland 7, Calif., is a portable instrument for measuring high a-c voltages quickly, easily, and safely in both wet and dry weather. The lineman or operator is not exposed to the hazard of high voltage current. This instrument is light and compact.

The instrument consists of a test prod, a series resistance, indicating head, and a ground lead. Any standard hot stick with a tapped head



easily attaches to the safety voltmeter's 5/8-inch, 11 base stud. The instrument has two scales of 0-5 kv and 0-15 kv which are easily read at a distance of eight feet.

The positive action selector switch makes accessible the wide range of the safety voltmeter. The test prod

YOU CAN GIVE BETTER SERVICE CONTINUITY WITH

GREATER CAPABILITY

WESTINGHOUSE 1¼%-STEP REGULATORS

Here is a simple . . . and exclusive . . . design feature that makes a great deal of difference in the year-in and year-out performance of a regulator. The tap changer in Westinghouse regulators is isolated from the coils. Carbon formed during arcing is retained in the separate tap changer compartment. Result? Coils are kept clean . . . they operate cooler and retain higher load-carrying ability.

This is just one reason why a Westinghouse regulator can lead a longer and more useful life on your distribution line. For more facts, call your Westinghouse representative.
J-70924

Westinghouse URF and URL single-phase feeder voltage regulators

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Westinghouse

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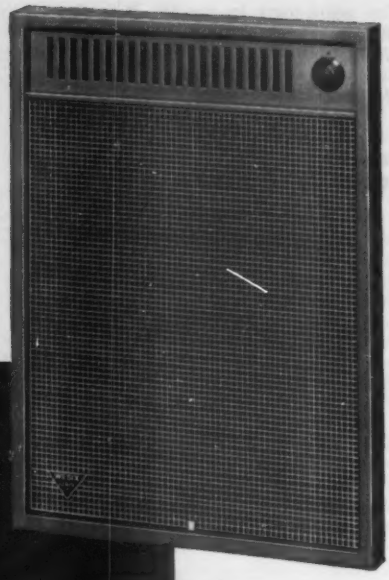
Ion-Balanced Air for home heating offers

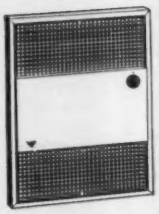
- better health
- greater comfort
- easier breathing

NEW WESIX-IONIX ELECTRIC HEATERS

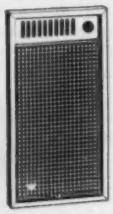


When you select NEW electric heating by WESIX-IONIX you choose a selling feature for any house. For here, in a system that's easiest of all to install in new or older homes, WESIX offers exclusive ion-balanced, comfort conditioned living.

Now you can offer *easier breathing, better health* and *perfect comfort.* Now room air stays fresh without that winter-stuffy feeling. Now your homes stay clean and free from air-borne bacteria, virus and pollens—because WESIX-IONIX destroys 90% of all airborne organisms.



And these new units are designed in styles, types and in price ranges to suit any building need. They're decorator designed and contractor engineered to bring a combination of customer-pleasing beauty and builder-pleasing ease of installation.



Be ready to profit from the growing demand for modern electric heating. Get all the facts on the most modern —Wesix-Ionix. Write for your complete catalog today.

Knowing these simple facts puts you out in front

Negative Ions—tiny particles that can not be seen under even the most powerful of microscopes—have opened new frontiers in the science of comfort and health-conditioning of the air we breathe.

Science has learned that pure air contains a high proportion of negative ions —while stale city air is usually high in positive ions. This excess of positive ions makes breathing difficult and slows up the efficiency of the respiratory system, and can aggravate symptoms of asthma and hay-fever.

Wesix-Ionix research has found ways to reduce positive ions and make air "Ion-balanced" like outdoor air at its best. This feature is built into all Wesix-Ionix heaters and works with out noise or moving parts and without using *any extra power* to keep the air in any home PURE, FRESH and HEALTHFUL around the clock!

WESIX ELECTRIC HEATER CO.
390 FIRST STREET • SAN FRANCISCO • CALIFORNIA

WESIX

may be any size or shape as per the user's requirement.

The test set is furnished complete with a standard 20 foot length ground lead; other lengths at the customer's option.

Write U-713 on reply card, page 93.

Improvements announced in pole bandage maker

THE NEWLY improved Pol-Nu Bandage-Maker, a device developed by Chapman Chemical Co., P.O. Box 138, Memphis 1, Tenn., is a portable machine that produces, in seconds, pole bandages of any size as they are needed. It was designed for use with Chapman Pol-Nu, grease-type preservative containing 10 per cent Pentacholorophenol.

New features include a spindle rod and brackets for feeding the 300-foot rolls of poly-kraft into the device, a removable top which keeps trash from falling into the hopper and also protects the paper roll, and simple rope handles for ease in carrying the machine.

Auxiliary improvements include the addition of inch-markings on the paper rolls to simplify measurement

of bandages as they are produced, and a plywood base available for users who wish to mount the Bandage-Maker on a pick-up truck bed. A knife groove in the base simplifies cutting bandages to proper length.

Write U-714 on reply card, page 93.

Self-elevating ladder easy to erect and stow

PRODUCTION of a new spring-loaded, self-elevating ladder rack assembly for use on service bodies having perpendicular rear panels has been announced by the Powers-American Division of McCabe-Powers Body Co., 5900 N. Broadway, St. Louis 15, Mo.

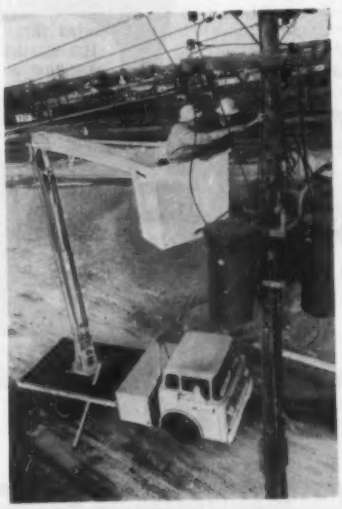
The assembly enables one man to quickly, easily and safely erect ladders up to 36 feet in length. As the ladder is pulled from its stowed position, it moves to the rear of the truck on six rubber-covered rollers in the support-guide section of the assembly. When the user exerts a slight downward pressure on the end of the ladder, four powerful coil springs take over a major part of the job to raise the ladder and steel support braces to a fully-erected position. Stowing the ladder is equally fast and easy.

The unit is available in sizes for use on bodies having top-of-compartment lengths of 75", 90" and 104". It is furnished with 28', 30', 32', 34' or 36' two-section extension ladder.

Write U-715 on reply card, page 93.

Aerial platform available with fiber glass boom

PITMAN Manufacturing Co., Grandview, Mo., announces that their aerial platform is now available with a fiber glass boom designed to afford maximum protection against electrical hazards. With the exception of bronze bushings at the point where the operator's platform attaches to the boom, all parts of the boom from the base outward are constructed of insulating materials. The boom has been tested with potentials of 230,000 volts a-c between the operator's platform and the grounded boom



base without flashover. Two models are available, the 40HFD for working heights up to 40 feet and 50HDF for working heights up to 50 feet.

Write U-716 on reply card, page 93.

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J-70925

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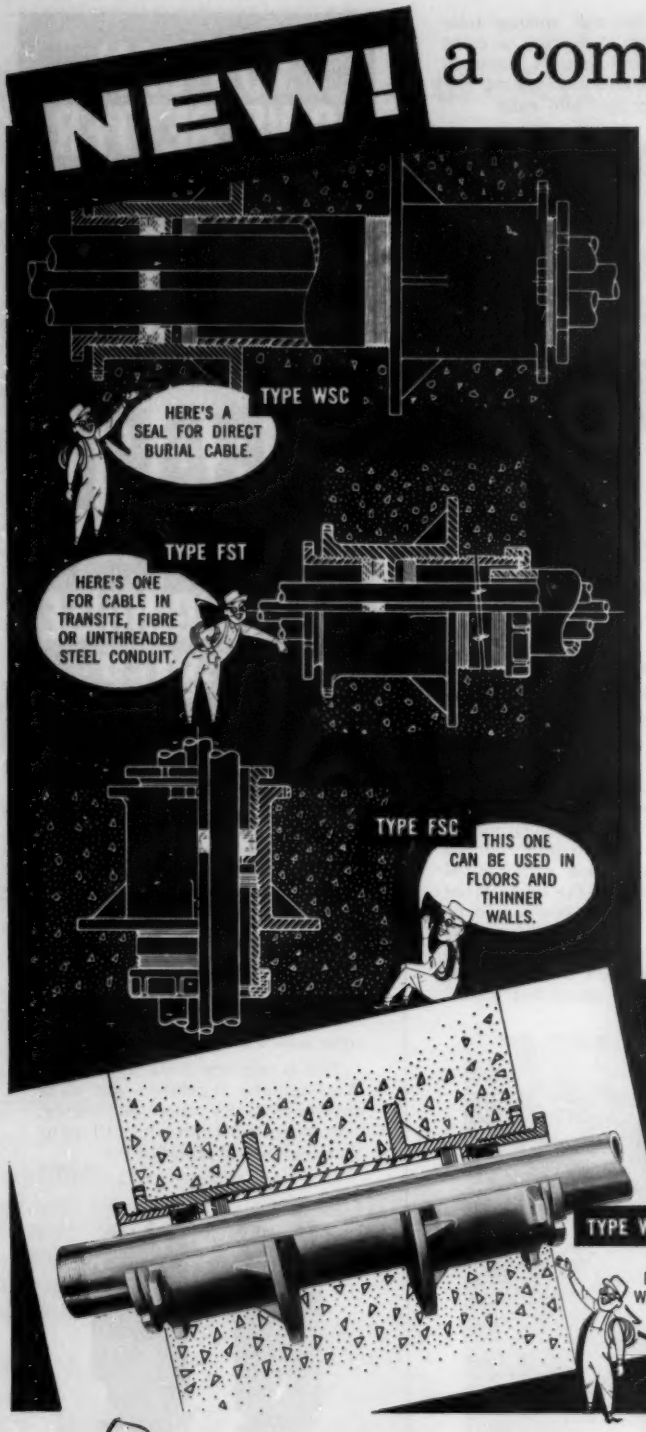
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HERE'S A SEAL FOR DIRECT BURIAL CABLE.
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THIS ONE CAN BE USED IN FLOORS AND THINNER WALLS.
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End leakage problems once and for all! O.Z.'s new wall and floor entrance fittings for installation in concrete provide a positively watertight seal around conduit or cable at any pass-through point! Use them with threaded or unthreaded steel conduit, fibre or Transite® conduit, or exposed cables of varying number and sizes. Gland-type sealing assemblies, with pressure bushings, may be tightened at any time. Fittings accommodate conduit ranging from ¾" to 6". Standard types, sizes available from stock. Specials made to order.

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LIGHTING CONTROL—The Arrow-Hart and Hegeman Electric Co., 103 Hawthorn St., Hartford 6, Conn. offers a one-page information sheet on their new quiet, tap action, lighting control switch, designed to fit any standard toggle wall plate.

Write in No. A100 on card, Pg. 93

FITTINGS AND FIXTURES — Information relative to explosion-proof fittings, fixtures, plugs and receptacles, and accessories is available in a 50-page book illustrating the complete line of these products manufactured by Killark Electric Mfg. Co., Easton and Vandeventer Ave., St. Louis 13, Mo.

Write in No. A101 on card, Pg. 93

ELECTRICAL BOXES—Steel City Electric Co., 1207 Columbus Ave., Pittsburgh 33, Pa., offers a catalog of their complete line.

Write in No. A102 on card, Pg. 93

STEEL WIRE—Technical information on Alumoweld, a newly developed aluminum-covered steel wire and strand, is contained in a 12-page catalog, just issued by the Wire and Cable Division of Copperweld Steel Co., 322 Frick Building, Pittsburgh 19, Pa. Illustrated and documented with engineering data, the colorful catalog provides a complete working knowledge of this new material—its properties, advantages, applications and construction practices.

Write in No A103 on card, Pg. 93

ELECTRICAL FITTINGS — A 40-page illustrated catalog and price list on the Gedney line. Shown and listed are conduit, threaded entrance, SEC, EMT and ground fittings and box connectors for both armored and nonmetallic cables. Copies are available from Gedney Electric Co., RKO Bldg., Radio City, New York 20, N. Y.

Write in No. A104 on card, Pg. 93

CONSTRUCTION ANCHORS—"Anchoring for Power and Communication Lines," a completely illustrated manual on improving line construction with better anchoring, has been published by the Advertising Dept., the A. B. Chance Co., Centralia, Mo. The 25-page booklet shows how to install the right anchor at the right place in the right way.

Write in No. A105 on card, Pg. 93

SERVICE PANELS — Information on protective electrical control centers for homes, apartment buildings, service stations, and industrial applications is contained in Bulletin PM-385, "BullDog Pushmatic Electric-Centers," issued by BullDog Electric Products Co., 7610 Jos Campau, Detroit, Mich.

Write in No. A106 on card, Pg. 93

ELECTRICAL FITTINGS — Blackhawk Industries, Dubuque, Iowa, offers a complete catalog of electrical conduit and cable fittings. Also a special publication giving detail drawings and instructions for installing service entrance masts on low or ranch type buildings.

Write in No. A107 on card, Pg. 93

WIRE PULLING LUBRICANT — Illustrated six-page folder showing the advantages of an improved Y-Er Eas wire pulling lubricant is available from Electro Compound Co., 4145 W. 150th St., Cleveland 11, Ohio.

Write in No. A108 on card, Pg. 93

GENERAL CATALOG — General catalog of Royal Electric Corporation, Pawtucket, R. I. covering flexible, service and lamp cords, cord sets, extensions, trouble lights, wiring devices and fuses is available to wholesalers. Dealers catalogs may be secured from Royal distributors.

Write in No. A109 on card, Pg. 93

CARBON PRODUCTS—A 28-page catalog on Motor and Generator Brushes and carbon products telling how to order brushes, grade recommendations, characteristics, and description of brush grades, is available from the Helwig Co., 2536 North 30th St., Milwaukee, Wis.

Write in No. A110 on card, Pg. 93

POWER BENDER — The lightweight hydraulic power bender #884, manufactured by Greenlee Tool Co., of Rockford, Ill., is described in a new bulletin issued by the company.

Write in No. A111 on card, Pg. 93

ELECTRICAL EQUIPMENT—The Wadsworth Electric Mfg. Co., Inc., Covington, Ky., has issued a new catalog 58' Guide, containing data on their line of Safety Switches, Service Equipment, Distribution Panels, "E-Z-RED" Circuit Breakers, interchangeable and non-interchangeable, also wiring troughs.

Write in No. A113 on card, Pg. 93

COMPRESSION CONNECTORS—New and fully illustrated Bulletin 13 offered by the James R. Kearney

YOU CAN GIVE BETTER SERVICE CONTINUITY WITH

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WESTINGHOUSE 1¼%-STEP REGULATORS

Here is a Westinghouse innovation that provides dual protection, but which is simplicity itself. A single-bolt domed cover permanently seals out moisture and air to prevent acid formation. In addition, this uniquely constructed cover has sufficient flexure to relieve any excessive internal pressures.

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J-70926

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CATALOGS and BULLETINS

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Corp., 4236 Clayton Ave., St. Louis 10, Mo., shows their complete line of Squeezon compression fittings. They make all overhead distribution connections from line wire to ground rod on aluminum, ACSR, copper, or combinations of them. Application and installation data are given for tap connectors of several types; service entrance, splicing, jumper and repair sleeves; terminals, stirrups and ground fittings. Mechanical and hydraulic installing tools for both dead and hot line work are listed.

Write in No. A114 on card, Pg. 93

SELECTING FUSES — A 12-page descriptive handbook "Fuseology tells how to get safest most dependable, trouble-free electrical protection from fuses. Contains useful information on selecting right size and type of fuses —how to stop needless blows—avoiding poor contact and other troubles. Issued by Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo.

Write in No. A115 on card, Pg. 93

LIGHTING FIXTURE DATA—The Perfeclite Co., 1457 East 40th Street, Cleveland 3, Ohio, makes available the following literature: (1) Data Folder 54-B—4 pages of engineering information, prices and specifications on Plastic Indirect Concentric Ring Luminaires. (2) Data Folder EX-57—10 pages of information on Exit Units for all building locations. Complete Engineering data and prices given. (3) Data Folder 56-A—Information on Ceiling Pan Fixtures and Vapor Proof Prismatic Exterior Fixtures. (4) Data Folder 58-A on Concrete Mounting Boxes for recessed incandescent units. (5) Data Folder 58-B on Fluorescent Exit Units. (6) Data Folder 58-C on Phosphorescent Exit Units. (7) Data Folder 57-A on extra shallow recessed units and square ceiling pans. (8) Catalog 956—60 pages plus 12-page supplement, complete with descriptions and engineering information. (9) Data Sheet 58-D—a two-page description of square ceiling pan units and exterior conduit mounted-pan-type units.

Write in No. A117 on card, Pg. 93

ELECTRICAL ENCLOSURES — Catalog No. 5354 currently being offered to the trade by B & C Metal Stamping Co., 590 Means St., N. W., Atlanta, Ga., is a well-organized compact 94-page manual giving complete descriptive information, prices, and specifications on all items in the B & C line of electrical enclosures. Copies are available free of charge to electrical contractors.

Write in No. A119 on card, Pg. 93

ELECTRICAL FITTINGS—Concise 36-page catalog illustrates and describes a complete line of electrical fittings, cable racks and wiring specialties. The catalog contains many detail drawings, clear-cut photographic illustrations of mast fittings, cable connectors,s traps, hangers and ground clamps in a wide variety of types and sizes. For your free copy, write The M. & W. Electric Mfg. Co., East Palestine, Ohio.

Write in No. A120 on card, Pg. 93

CABLE CONNECTORS — Tomic Sales and Engineering Co., 20000 Sherwood Ave., Detroit 34, Mich., now have available catalog sheets containing data on the complete line of their connectors, couplings, and cable connectors.

Write in No. A121 on card, Pg. 93

WIRING DEVICES — A complete new catalog of wiring devices is now available from Bell Electric Co., 5735 S. Claremont Ave., Chicago 36, Ill. The line includes a wide range of weatherproof receptacles and switches, portable garden lights, wall plates, and specialty items.

Write in No. A122 on card, Pg. 93

PLUG-IN REELITE — Complete details about Appleton's lightweight, portable automatic Reelites are given in an attractive 4-page catalog insert. These devices find application in a wide range of occupancies: garages, loading docks, garment industry, construction crews, warehouses, machine shops, etc. Write to Appleton Electric Co., 1701 Wellington Ave., Chicago 13, Ill.

Write in No. A124 on card, Pg. 93

WIRING PRODUCTS — Various features of P&S Despard interchangeable wiring devices and detailed information concerning this line are offered in a brochure released by Pass & Seymour, Inc., Dept. ES, Syracuse 9, N. Y. Included are such features as Camstrap for quick, easy installation, three-wire grounding, and pressure terminal devices.

Write in No. A125 on card, Pg. 93

FLUORESCENT BALLASTS—Advance Transformer Co., 2950 N. Western Ave., Chicago 18, Ill., has recently completed the compilation and printing of a 20-page catalog on fluorescent ballasts and their use. Included are data sheets on available Advance ballasts and a comprehensive installation and operation section and testing procedures. Copies of the booklet are available on request.

Write in No. A126 on card, Pg. 93

GUTH INDUSTRIAL LIGHTING BROCHURE — New 8 page, 4 color brochure by The Edwin F. Guth Company, 2615 Washington Blvd., St. Louis 3, Missouri, describes Guth KOLORKODED industrial lighting fixtures. This unique innovation of color coding luminaires opens a new field in industrial lighting. Folder includes photographs, lighting data, engineering information and complete descriptive data on KOLORKODED luminaires and standard RLM reflector units. Write for your free copy.

Write in No. A127 on card, Pg. 93

WIRING DEVICES — Catalog No. 56, and New Product Bulletins, containing the complete electrical wiring device line of Leviton Mfg. Co., Inc. Brooklyn 22, N. Y. Over 100-pages accurately illustrated and containing electrical and circuit wiring diagrams. Complete cross index for easy reference. Featured are Specification Grade Devices, Interchangeable line, Lev-O-Lock line, and many, many others; devices for every possible use in Industrial, Commercial and Residential applications.

Write in No. A128 on card, Pg. 93

ELECTRICAL CONDUITS — "National Electric Conduits" is the 20-page Catalog No. 603 which describes and illustrates the many types of electrical conduits manufactured by National Electric Products Corp., 2 Gateway Center, Pittsburgh 22, Pa.

Write in No. A129 on card, Pg. 93

ANCHORING DEVICES—An illustrated 32-page catalog, No. 70, describing more than 25 anchoring and drilling devices for making fastenings to masonry, is available from the Arro Expansion Bolt Co., Marion, Ohio.

Write in No. A131 on card, Pg. 93

CONNECTORS — Comprehensive, up-to-date information on electrical connections for overhead lines in transmission and distribution is now available in one convenient publication, a 100-page manual issued by Burndy Corp., Norwalk, Conn., on connection techniques, connectors, and installation tooling.

Write in No. A132 on card, Pg. 93

CONDUIT FITTINGS—A new 24-page catalog, illustrating a complete line of conduit fittings, oval bodies type LB, LL, LR, and T, and lighting

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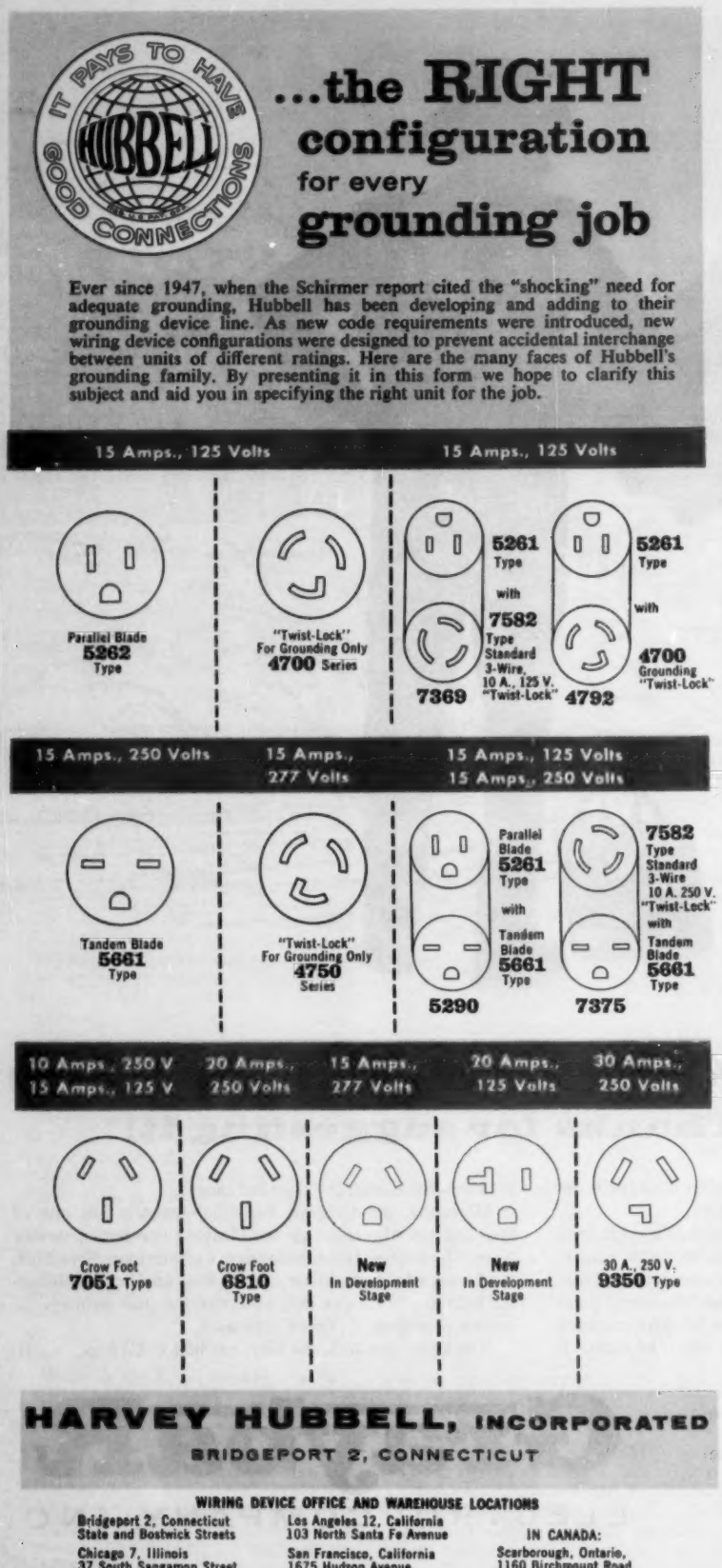
IT PAYS TO HAVE GOOD CONNECTIONS
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...the RIGHT configuration for every grounding job
Ever since 1947, when the Schirmer report cited the "shocking" need for adequate grounding, Hubbell has been developing and adding to their grounding device line. As new code requirements were introduced, new wiring device configurations were designed to prevent accidental interchange between units of different ratings. Here are the many faces of Hubbell's grounding family. By presenting it in this form we hope to clarify this subject and aid you in specifying the right unit for the job.
15 Amps., 125 Volts
15 Amps., 125 Volts
Parallel Blade 5262 Type
"Twist-Lock" For Grounding Only 4700 Series
5261 Type with 7582 Type Standard 3-Wire, 10 A., 125 V. "Twist-Lock" 7369
5261 Type with 4700 Grounding "Twist-Lock" 4792
15 Amps., 250 Volts
15 Amps., 277 Volts
15 Amps., 125 Volts
15 Amps., 250 Volts
Tandem Blade 5661 Type
"Twist-Lock" For Grounding Only 4750 Series
Parallel Blade 5261 Type with Tandem Blade 5661 Type 5290
7582 Type Standard 3-Wire 10 A. 250 V. "Twist-Lock" with Tandem Blade 5661 Type 7375
10 Amps., 250 V
15 Amps., 125 V
20 Amps., 250 Volts
15 Amps., 277 Volts
20 Amps., 125 Volts
30 Amps., 250 Volts
Crow Foot 7051 Type
Crow Foot 6810 Type
New In Development Stage
New In Development Stage
30 A., 250 V. 9350 Type
HARVEY HUBBELL, INCORPORATED
BRIDGEPORT 2, CONNECTICUT
WIRING DEVICE OFFICE AND WAREHOUSE LOCATIONS
Bridgeport 2, Connecticut State and Bostwick Streets
Chicago 7, Illinois 37 South Sangamon Street
Los Angeles 12, California 103 North Santa Fe Avenue
San Francisco, California 1675 Hudson Avenue
IN CANADA:
Scarborough, Ontario, 1160 Birchmount Road

parts is now available from Elliott Electric Products Co., 1513 Olmstead Ave., New York 62, N. Y.

Write in No. A133 on card, Pg. 93

CONDUIT—Clayton Mark and Co., 1900 Dempster St. Evanston, Ill., has issued a bulletin describing their electrical metallic tubing, Electric-tube, and rigid steel conduit. The booklet is illustrated and contains information on design features, applications, and catalog data.

Write in No. A134 on card, Pg. 93

ANTI-CORROSIVE PAINTS — Subox, Inc., Fairmount Plant, Hackensack, N. J., announces the availability of literature on their lines of anti-corrosive paints and coatings. Subox paints give protection for years and largely eliminate the need for scraping and repriming when repainting.

Write in No. A135 on card, Pg. 93

ELECTRIC TOOLS—A new catalog from Milwaukee Electric Tool Corp., 5316 West State St., Milwaukee 8, Wis., contains information on their lines of heavy duty electric tools for contractors and industry. The 34-page bulletin gives design features, specifications, and catalog information on all tools listed.

Write in No. A136 on card, Pg. 93

HYDRAULIC HOLE DIGGER — McCabe-Powers Body Co., 5900 N. Broadway, St. Louis 15, Mo., announces the publication of a folder describing the "Earth Master" hydraulic hole digger, series EM-2, which digs holes up to 30 inches in diameter.

Write in No. A137 on card, Pg. 93

ELECTRICAL EQUIPMENT — A new 12-page pictorial bulletin briefly describes manufacturing facilities and electrical products of Crouse-Hinds Co., Syracuse 1, N. Y. Emphasis is on the variety of equipment available in the four product lines: Condulet electrical equipment, floodlights, aviation lighting equipment, and traffic control.

Write in No. A138 on card, Pg. 93

FEATHERTOUCH SWITCHES—Literature punched for standard catalog binders is now available from H. J. Theiler Corp., Whitinsville, Mass., describing the Theiler lifetime Feathertouch switches which feature a unique floating rocker-arm action and whisper-quiet operation. Other features of the line are fast, positive connections, operating in any positive connections, operating in any operation under normal conditions.

Write in No. A139 on card, Pg. 93

POWER OUTLETS—Weatherproof utility power outlets in a wide range of capacities and designs are described in literature now available from Midwest Electric Products, Inc., Mankato, Minn. These power outlets are well suited to many outdoor applications such as temporary services, trailer parks, etc.

Write in No. A140 on card, Pg. 93

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Understanding the Code

◆ A GREAT ADVANTAGE when studying a multitude of rules about any given subject, is to have at hand, first of all, the basic objectives of these rules, that is, their intent and purpose. Then as each rule is individually considered, it can be thought of as one step toward achieving the basic objectives. The individual rules then tend to "make sense" and are more easily learned and remembered.

In this issue, therefore, as we study Conductors in Article 310 of the Code, we should absorb thoroughly these basic objectives set forth in section 3101, as follows:

"The intent and purpose of the following rules is to provide that conductors shall have mechanical strength, insulation, and carrying capacity adequate for the particular conditions under which they are to be used." A controversial fine print note follows this section which is identical in purpose to another such note following section 3001 which was discussed in the April issue of this magazine in an attempt to explain the reasoning behind it. Hence, we will quote the fine print note following this section 3101 without further explanation as follows:

"The provisions of this article are not intended to apply to conductors which form an integral part of equipment such as motors, motor controllers, and the like, or which are provided for elsewhere in this Code."

Basic requirements

For our purposes, then, we have to meet three basic requirements which are mechanical strength, insulation, and carrying capacity in a manner suitable for the conditions of use, location, and temperature. The table in section 3102 lists various types of conductors, their designating letter-types, maximum operating temperatures, permitted uses, permitted locations (dry or wet, etc.), and maximum voltages. Where voltage is not shown, the maximum permissible voltage is always 600 volts.

The table in section 93101 shows manufacturing details of conductors. Table 31 in Chapter 10 shows the needed information for various flexible cords. And tables 1, 1a, 2, and 2a in Chapter 10 list the maximum current-carrying capacities with temperature-correction factors included in the lower portion of the tables. There are 10 notes following this latter group of tables which are to be used in connection with them when they are applicable.

There is a difference between conductor insulation and conductor covering. A covering, although it may offer a small degree of insulating value under certain dry and ideal conditions, is not an insulation in the usual sense and is not to be treated as such.

Weatherproof Type WP wire, for instance, has a covering but no insulation, and it cannot be used in a raceway or in any other manner where an insulated conductor is needed. It must be treated as bare wire. It *does* prevent, or materially reduce, chemical action on the wire when buried in soil, however, such as where a bare neutral service conductor would ordinarily be permitted but where soil conditions are such that a bare metal would be eaten away or oxidized. Not only does such a covering re-

Code test questions

1. Conductors shall be insulated, except when covered or bare conductors are specifically permitted in the Code. True or false?

2. Suitability of wire for use as conductors is judged principally on its mechanical strength, insulation, and current-carrying capacity. True or false?

3. Unless otherwise specified, conductor insulation is suitable for a maximum of 250 volts. True or false?

4. Type MI cable is approved by the Code for direct burial in the earth. True or false?

5. Conductors size No. 8, if installed in raceways, shall be stranded. True or false?

6. Conductors for general-use branch circuits shall be not smaller than:

(a) No. 14 if solid and No. 12 if stranded.

(b) No. 14 if stranded and No. 12 if solid.

(c) No. 14 whether solid or stranded.

Which is correct? a? b? c?

7. Conductors may be connected in multiple only in sizes:

(a) No. 1 and larger.

(b) No. 1/0 and larger.

(c) No. 3/0 to 500 MCM.

Which is correct? a? b? c?

8. Conductors having Type RH-RW insulation may be used in either wet or dry locations and have a carrying capacity equal to that of wire of the same size having Type RH insulation when such RH-RW conductors are used:

(a) in either wet or dry locations.

(b) in wet locations only.

(c) in dry locations only.

Which is correct? a? b? c?

9. Conductors having Type RHW insulation may be used in either wet or dry locations and have a carrying capacity equal to that of wire of the same size having Type RH insulation when such RHW conductors are used:

(a) in either wet or dry locations.

(b) in wet locations only.

(c) in dry locations only.

Which is correct? a? b? c?

10. Copper conductors with Type RHH insulation have a carrying capacity greater than that of copper conductors with Type RH insulation:

(a) in sizes larger than No. 10.

(b) in sizes smaller than No. 10.

(c) in all available sizes.

Which is correct? a? b? c?

Correct answers will be found at end of article on page 125.

sist chemical actions of soil, but it affords a small amount of mechanical protection. (I suspect that the 1959 Code will forbid bare neutrals buried directly in the earth without coverings unless inserted in ducts or conduit.)

Where there is any significant amount of sulphur or acid content in soils, bare grounding conductors should not be laid directly in contact with the earth, especially if aluminum conductors are used. (Even aluminum conduit, unless encased in non-cinder fill concrete, should not be buried in acid soils unless thoroughly coated with asphalt tar or other protective coatings.)

Buried conductors

Only two types of insulated conductors are specifically permitted by the Code to be buried in direct contact with the earth. These are Type USE and Type UF. Type UF must be protected by overcurrent devices and is therefore restricted to feeders and branch circuits. Type USE may be used for these purposes and also for service entrance conductors.

Additional mechanical protection may be, and usually is, required by inspection authorities for direct burial conductors. This protection usually consists of raceways where the conductors emerge from the earth at each end of the run and a two-inch bed of sand plus creosoted planks over the center section. The depth of burial should be below the permanent frost line.

Any type conductor which is approved for wet locations may be installed in approved underground raceways. Such conductors include lead-sheathed and Types RW, TW, RHW, and RH-RW. Types RW and TW are approved for a maximum temperature of 60 C whether in a wet or dry location. Type RHW is approved for a maximum temperature of 75 C whether in a wet or a dry location. Type RH-RW is approved for a temperature of 60 C in wet locations and 75 C in dry locations.

Therefore Type RH-RW carries only "TW rating" (column 2 in tables 1, 1a, 2, and 2a) when used in wet locations, but it carries "RH rating" (column 3 in these tables) when used in dry locations. (Type RH can be used only in dry locations).

As now stipulated in section 3102-b, Type MI cable could be required by inspectors to be installed in raceways when used underground. This section states, "Such conductors are not suitable for direct burial in the earth unless of a type specifically approved for the purpose." Section 3302 lists its many uses, but it does not authorize direct burial. A great many inspectors, nonetheless, will, no doubt, permit direct burial of Type MI cable. It is my personal opinion that a protective coating, such as asphalt tar, is all that is needed to insure a safe installation for Type MI cable when buried in the soil except where additional mechanical protection may be required, such as treated planks a few inches above the cable.

Section 3102-c states, "Conductors exposed to oils, greases, vapors, gases, fumes, liquids or other substances having a deleterious effect upon the conductor or insulation shall be of a type approved for the purpose." Type NMC is approved for wet and mildly corrosive locations. But for oils, greases, and gasoline locations, section 5023 states, "Where condensed vapors and liquids may collect on or come in contact with the insulation or conductors, such insulation shall be of a type approved for use under such conditions or the insulation shall be protected by a sheath of lead or by other approved means."

Section 3302 approves Type MI cable for exposure to such corrosive influences. Type TW insulation which is covered with a Nylon jacket and which states on the insulation "Gasoline And Oil Resistant" is listed by the UL as safe for such locations when the temperature does not exceed 60 C. This temperature limitation under such corrosive conditions for Nylon-jacketed wire was limited, at first, to 30 C but has since been changed to 60 C.

This change was a boon to the Southern and Southwestern states where normal summer temperatures consistently exceeded the former limitation of 30 C. In such areas, where expensive lead-sheathed conductors with the necessarily larger raceways were formerly mandatory, the Nylon-jacketed gasoline and oil resistant conductors are now permissible by the Code.

Type MI cable has only recently become permissible by the Code for such locations, and even now it is permissible only when the special fittings approved for the purpose are used in connection with the cable.

Conductors are required to be not smaller than size No. 14 except for special uses where mechanical strength is either of little consequence or where such strength is provided for by means of cord assemblies, and then only where currents are very small and where the interruption of current flow would not likely result in fire from arcing or in other damage. These exceptions, which are listed in section 3103, permit size No. 18 for cords, fixtures, and short fractional horsepower motor connections to terminals; No. 16 for machine tools, remote-control, low-energy power, low-voltage power, signal circuits, and cranes and hoists; and No. 20 for machine tool electronic circuits and for elevator control and signal circuits.

In general, however, conductors are required to be at least size No. 14 whether stranded or solid. The trend is toward a minimum of No. 12 in commercial and industrial occupancies.

Some residences, also, are using nothing smaller than No. 12 because of the multiplicity of heavy appliances throughout the home instead of just in the kitchen and dining areas.

Others are still using No. 14 but are connecting fewer outlets to each circuit and increasing the number of circuits for any given area. No. 12, of course, is the minimum size permitted for small appliance circuits in kitchen and dining areas in residences.

Conductor sizes No. 6 and larger are required to be stranded when pulled in raceways. This is because the additional flexibility afforded by stranding is needed for pulling these larger sizes through raceways. Bus bars and Type MI cable are exempt from this requirement because they are not "pulled" into raceways, except that Type MI cable, if installed underground, may be required by some inspectors to be so installed. In such a case, a raceway or duct of larger than normal size would be needed.

Parallel conductors

Conductors may be connected in multiple in sizes 1/0 and larger. Such conductors must be of the same length, size, and type of insulation. They must be terminated " . . . at both ends in such a manner as to insure equal division of current between all conductors involved."

This is important. If two conductors are connected in parallel and No. 1 conductor has more re-

sistance than No. 2, a greater amount of current will flow through No. 2 conductor—the path of least resistance—overload No. 2 until, by this overloading, the resulting heat creates resistance in excess of that in the No. 1 conductor. Then the major current flow will be through No. 1 until

(Continued on page 124)

Questions on the Code

(Readers are invited to send in questions which they would like to see discussed in this department.)

Single raceway for three-way travelers

QUESTION: A contractor in my territory ran a piece of 2-conductor armored cable for the travelers between two 3-way switches. I asked him to change it, which he did. But he asked me why and to show him the Code rule on it. I know it is wrong, but I can't tell him why or show him the Code rule. Please give section number of rule and explain.

ANSWER: Section 3802 states, "Three-way and four-way switches shall be so wired that all switching is done in the ungrounded circuit conductor. Wiring between switches and outlets shall, if in metal enclosures, be run with both polarities in the same enclosure." This is the Code requirement for both polarities (neutral and hot wire or wires) to be within the same metal enclosure, such as the armor of armored cable.

The reason for not permitting a 2-wire armored cable as the travelers is because the neutral would be on the outside of this metal enclosure. This would cause heating from induction. Section 3018 states, "Where run in metal raceways or cable armor . . . the conductors of circuits operating on alternating-current shall be so arranged as to avoid overheating of the metal by induction . . . "

No. 14 switch legs for 20-ampere circuit

QUESTION: Is it permissible to use size No. 14 switch legs on 20 ampere lighting circuits when No. 12 is used for all parts of the circuit except the switch legs?

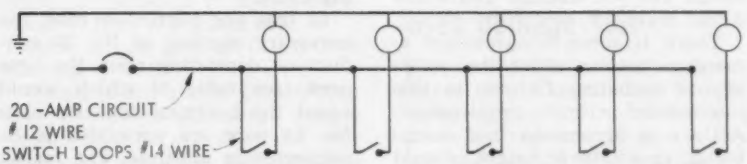
ANSWER: Some switch loops control the entire connected circuit load. For this arrangement, the answer is definitely "No." In other arrangements, only parts of such loads are controlled by any single switch. In many cases, there is a separate switch for each light. The latter arrangement probably is the one which interests you. In my opinion, the answer to your question in such a case would be "Yes."

Section 2403-g states, "Remote Control. Except as provided in Article 725, the conductors of the control circuits of remote-control switches shall be considered as protected from overcurrent by overcurrent devices that are not of the so-called time-lag type and are rated or set at not more than 500 per cent of the carrying capacity of the remote-control conductors, as specified in tables 1 and 2 of Chapter 10."

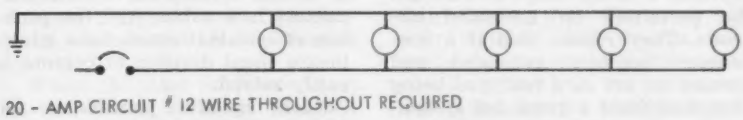
Technically, the answer is "No" if time-lag fuses or circuit breakers are used for branch circuit protection. And remote-control circuits are defined as "Any electrical circuit which controls any other circuit through a relay or an equivalent device." Again, technically, the answer is "No" if no relays or similar devices are used. This is why I said above that if the switch loop controlled the entire or a major portion of a connected load, the answer is definitely "No."

But even though there is no definite Code basis for my answer, the intent of the above quoted section seems to indicate that any control circuit which carries but a fraction of the connected load may be reduced in size provided that this reduction would not result in any inherent hazards. Since, in the arrangement in question, a short-circuit would result in nothing more hazardous than a light turned on unintentionally, I can not see how this could be an infraction of any basic Code rule of safety. Therefore, for the control of individual lights on 20-ampere circuits, my answer to your question is, "Yes, it is permissible to use No. 14 conductors for the control switch loops." See sketches.

I assume that the only purpose of such an arrangement is to offer the greater carrying capacity of No. 12 wire for the circuit load and still have the ease-of-handling found only in the smaller No. 14 for switch terminal connections.



Switch loops on individual lights are #14 wire. A short-circuit on any of the switch legs will not result in damage (see text). Each switch loop carries but a fraction of the circuit load. With this arrangement, there is no infraction of the Code.



Same circuit as above with one switch controlling all or major fraction of total circuit current. #12 switch loop would be required in such cases.

Important notes govern table use

QUESTION: I installed four No. 4/0 conductors for a 3-phase, 4-wire system in a 2½ inch conduit, and the inspector insists that I change this to 3 inch conduit because of the four wires. But Note 5 following tables 1 through 2a says, "A neutral conductor which carries only the unbalanced current from other conductors, as in the case of normally balanced circuits of three or more conductors, shall not be counted in determining current-carrying capacities as provided for in the preceding paragraph." So I say the neutral does *not* have to be counted on my balanced load. Which of us is right?

ANSWER: The inspector is correct. As you mentioned, Note 5 states that the neutral need not

be counted " . . . *in determining current carrying capacities as provided for in the preceding paragraph.*" The preceding paragraph, which is Note 4, requires derating when more than three conductors are installed in a raceway. Note 5 permits you to ignore a balanced neutral conductor *for this purpose of derating only.* In other words, you would be allowed full carrying capacity with the four wires because one carries no appreciable amount of current. The four are treated as three and not required to be de-rated to 80 per cent. But in selecting conduit size, all four wires must be counted. (Don't overlook the fine print note following Note 5 which reminds us that in some instances, the neutral carries full current and is not to be treated as a neutral for derating purposes).

Ungrounded circuits in operating rooms

QUESTION: Are lighting fixtures which are installed more than 5 feet above the floor in hospital operating rooms required to be supplied by ungrounded circuits in the same manner as receptacle circuits?

ANSWER: This is a controversial question. I believe that it is the intent of the Code to have all lighting as well as all receptacles on ungrounded circuits even when these are above the 5-foot level. Such fixtures and receptacle outlets need not be of the explosion-proof type when above the 5-foot level, but they should be on ungrounded circuits. This is another instance in which Code intent is not clearly understood because of the wording used to state the rules. This wording is interpreted in various ways because of the statements in section 5135-a-2, 5135-b-2, and 5135-f-1.

Section 5135-f-1 states, "Each circuit within or partially within an anesthetizing location as defined in sub-paragraph a-2 of this section shall be controlled by a switch having a disconnecting pole in each circuit conductor, and shall be supplied from an ungrounded distribution system which shall be isolated from any distribution system supplying areas other than anesthetizing locations. Such isolation may be obtained by means of one or more transformers having no electrical connection between primary and secondary windings, by means of motor generator sets, or by means of suitably isolated batteries."

Sub-paragraph a-2 (section 5135-a-2) states, "Anesthetizing locations are areas in hospitals in which combustible anesthetics are or may be administered to patients. Such locations shall include operating rooms, delivery rooms and anesthesia rooms, and will also include any corridors, utility rooms, or other areas which are or may be used for administering combustible anesthetics to patients. Recovery rooms are not classed as anesthetizing locations unless used for administering combustible anesthetics."

These two paragraphs of this section, taken alone, leave no doubt that all circuits within or partially within these areas are to be on isolated ungrounded circuits, including lighting fixtures above the 5-foot level. And this is the intent of the Code.

Sub-paragraph b - 2 (section 5135-b-2), however, causes other interpretations to be applied to this section. This paragraph states, "In an anesthetizing location as defined in paragraph a, the entire area shall be considered to be a Class I, Division 1, location which shall extend upward to a level 5 feet above the floor." This is why some electrical men think that circuits above the 5-foot level are exempt from the ungrounded circuit requirement, because the area does not extend above this level. But this paragraph does not say that. It says that the Class I area does not extend above this level. In other words, explosion-proof requirements *are* exempt above the 5-foot level. Ungrounded circuit requirements are *not* exempt above the 5-foot level.

There is some disagreement among inspectors about the necessity of including fixtures in this ungrounded circuit requirement. All are in agreement that receptacles, at whatever height, should be supplied by ungrounded circuits, because these supply the operating devices and equipment whether such receptacles are above or below the 5-foot level. But fixed lighting fixtures in the opinion of many inspectors should be permitted on grounded circuits. They reason that if a conductor becomes grounded and causes an arc as a result of being supplied from a grounded system, it is out of the hazardous area and the required enclosure or screen would prevent any hot particles from falling to the explosive area. Therefore, they feel that grounded circuits for fixed lighting would be safe. In my own opinion, I believe that enclosed fixed lighting fixtures would be safe when mounted above the 5-foot level in hospital operating rooms provided that separate raceways were required for the ungrounded receptacle circuits to prevent inadvertant interchange of conductors between the two systems.

As of now, however, this is not permitted, and all such circuits in such areas are required to be supplied by an ungrounded system.

No contradiction in paralleling rule

QUESTION: Please explain the following discrepancy: Section 3105 says, "Conductors in sizes 1/0 and larger may be run in multiple provided they are of the same length and have the same circular-mil area and type of insulation." Section 6205 paragraph a subparagraph 1 says, "For lighting circuits: No. 14, except that No. 20 or larger conductors may be used in parallel provided the carrying capacity is equivalent to at least that of No. 14 wire."

ANSWER: Section 3105 applies to conductors in general and is a basic general rule to be followed except as specifically permitted elsewhere for a particular case. Section 6205 is such a special case and the sub-paragraph a-1 concerns only a single particular instance—the conductors for elevator lighting circuits which are contained inside of an elevator traveling cable.

In this one particular case, the necessary number of No. 20 conductors, depending upon the type used (see table 3) which would equal the carrying capacity of a No. 14 wire are permitted to be connected in multiple. The reason for this is the added flexibility needed in a traveling cable. Inside of such a cable, mechanical protection is integral with the cable as used in the shaft. The current value is very small. Equal length is almost automatic for all conductors in a cable. And the problem of terminal connections which insure equal division of current is easily solved.

Such specific permission for such special uses in no way voids or conflicts with general rules for general uses.

Know the law

by Arthur L. H. Street

Decision on city licensing

◆ WE HAVE previously referred to several California appellate court decisions, concerning the right of a city to curtail by ordinance, rights acquired by an electrical contractor under a state licensing law.

In a decision rendered February 2, 1959, the California Supreme Court, as the highest tribunal in that state, settled this proposition of law:

Where ordinance requiring license fee limited right of electrical contractor holding state license to contract in city unless he paid city prescribed fee and obtained permit from city, requirement for payment of fee and obtaining permit nullified permission given contractor by general law to conduct his business at any place in state and penal provisions of such ordinance were therefore invalid. (Agnew v. Culver City, 334 Pac. 2d 571.)

Four points decided in Florida case

◆ A VARIETY of legal problems were presented for decision by the Florida District Court of Appeals, Third District, in the case of Diana Stores Corporation v. M.&M. Electric Co., Inc., 108 So. 2d 486.

Here is the gist of the court's rulings:

Where plans stated that wiring for an air-conditioning system should be a part of electrical contract and electrical specifications referred to plans for the extent of air-conditioning work, the electrical subcontractor was obligated to furnish material and labor for air-conditioning system as part of his contract for completion of electrical work and general contractor was not obligated to do the electrical work for the air-conditioning system.

Where the plans for construction of a building specified that the main service wire should be 500 MCM and 250 MCM when the city code required the size of wires to be 750 MCM and 350 MCM, the electrical subcontractor was entitled to an adjustment based on the differences between the increased cost of meeting city's requirements and the specifications on the plans, calculated as of the date of the contract.

Where electrical work was approximately 59 per cent completed when other work in construction of building was 95 per cent completed and the electrical subcontractor was timely cautioned of the importance of meeting schedule for doing the electrical work but failed to do so, the general contractor was justified in putting subcontractor off the job and letting contract for completion of electrical work to another on a cost-plus basis.

Where the lien of the subcontractor against real estate for electrical work performed in construction of the building was released on order of court by substitution of a bond filed by general contractor conditioned to pay any claim found due the subcontractor by the general contractor, a court order ordering owner of building which was under construction to pay electrical subcontractor amount found owing to him by general contractor was improper.

Injured electrician loses damage suit

◆ A SIGNAL device company's employee, while installing a burglar alarm system in an attic of a storeroom was injured in a fall resulting from the collapse of a section of acoustical ceiling on which he was crouched. He sued the building owner, a contractor, architects, subcontractor who constructed the ceiling, and the lessee of storeroom for whom system was being installed. Did the evidence show that the employee, who weighed 180 pounds, was negligent in walking on wood strippings to which the ceiling was nailed and that his negligence contributed to the happening of the accident?

Yes. The California District Court of Appeal, Second District, decided that the injured man was not entitled to collect damages from any of the defendants (Miller v. Kaiser Community Homes, 332 Pac. 2d 309).

The court said that even if it was customary for electrical workers to proceed as plaintiff did, that did not necessarily show that it was not careless to do so. The high spots of the court's opinion read:

"It * * * appears that the evidence was conflicting as to whether or not it was the custom for workmen to walk on such strippings. * * * even if it was a custom for workmen to walk on such strippings, the fact that plaintiff followed such custom, or the fact that he did not follow such custom, would not be determinative as to whether he was or was not negligent. * * * The evidence as to custom was to be considered with all the other evidence in determining whether plaintiff was negligent. The questions of negligence and contributory negligence were questions of fact for the determination of the trial judge. There was testimony of five expert witnesses (on behalf of defendants) that it was not the custom for workmen to walk on strippings. The 'cautious' action of plaintiff in testing the security of the strippings before he walked on them indicates that he was apprehensive regarding his safety if he walked on the strippings. He knew that the strippings were not resting on top of the runners or the wall ledges. He testified that he knew the strippings were fastened 'from below' (the runners and ledges), but he did not know how they were fastened. There was evidence to the effect that, on occasions, when it seemed necessary for a workman to put his weight on the strippings, the workman customarily would place a plank across strippings so that his weight would be distributed on several strippings. Plaintiff did not use a plank in that manner, but he stepped from one stripping to another, placing his weight (180 pounds) on single strippings. Just prior to the time the ceiling broke, plaintiff was not stepping from one stripping to another, but he was in a crouched position with his weight on one or two strippings.

New series of tables extended to include larger hourly rates

A NEW SERIES of estimating tables, completely revised in the light of more recent jobs and experience, are presented in this issue and will appear from month to month in forthcoming issues. These electrical estimating data sheets cover labor only and are arranged alphabetically with the basic material headings as a title for each tabulation.

Labor units given in these tabulations are based on a minimum of interference during work progress. The averages listed do not provide for abnormal job conditions, and any such abnormal conditions will require adjustments by the user, based on his experience.

The work units covered by each table are composed of one or more separate but closely related operations necessary for the complete installation of a particular basic item of electrical equipment. These operations associated with the basic material are described at the bottom of each table.

Most of the electrical estimating tabulations follow the same form. Column 1 at the left shows the size of the material to be installed. The second column from the left gives the time required to install the material, and it should be noted especially that this "productivity" column may be based on individual units or in the case of cable or conduit on units of 100 feet or 1,000 feet. The abbreviations "Ea." for each, "C" for hundreds, and "M" for thousands in Column 2 indicate the basis of the labor hours.

Columns 3 to 13, from the left, give the actual labor costs in dollars per unit of installation, at various hourly wage rates.

When calculations are being made for an hourly wage rate that doesn't correspond to any of the rates listed in Columns 3 to 13, the user may multiply the number of hours in Column 2 by 100 and this will give the labor cost based on an hourly wage rate of $1 per hour. By multiplying this by the hourly wage rate that actually applies in the user's locality, the exact labor cost of the operation may be obtained. Labor costs obtained in this way will be for units, hundreds of feet, etc., as given in heading of Column 2 of the table.

The labor units covered by the tables represent direct job labor costs and do not include delivery of material to site, engineering, estimating, or any other indirect cost.

As will be noted, some of the electrical estimating tabulations to be given will be for independent operations, such as excavating, backfilling, etc. These are included for use in preparing estimates on work of a special nature not covered under a specific table heading.

Tables will appear in alphabetical order.

ANCHORS LAG SCREW SHIELDS
IN BRICK (BY HAND)

BOLT SIZE	HOURS EACH	LABOR COST INSTALLED EACH AT FOLLOWING RATES										
		2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
3/16"	.23	.46	.52	.58	.63	.69	.75	.81	.86	.92	.98	1.04
1/4"	.23	.46	.52	.58	.63	.69	.75	.81	.86	.92	.98	1.04
5/16"	.29	.58	.65	.73	.80	.87	.94	1.02	1.09	1.16	1.23	1.30
3/8"	.35	.70	.79	.88	.96	1.05	1.14	1.23	1.31	1.40	1.49	1.58
1/2"	.42	.84	.95	1.05	1.16	1.26	1.37	1.47	1.58	1.68	1.79	1.89
5/8"	.50	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88	2.00	2.13	2.25
3/4"	.72	1.44	1.62	1.80	1.98	2.16	2.34	2.52	2.70	2.88	3.06	3.24
7/8"	.94	1.88	2.12	2.35	2.59	2.82	3.06	3.29	3.53	3.76	4.00	4.23
1"	1.10	2.20	2.48	2.75	3.03	3.30	3.58	3.85	4.13	4.40	4.68	4.95
1-1/4"	1.43	2.86	3.22	3.58	3.93	4.29	4.65	5.01	5.36	5.72	6.08	6.44
		IN CONCRETE (BY HAND)										
3/16"	.24	.48	.54	.60	.66	.72	.78	.84	.90	.96	1.02	1.08
1/4"	.24	.48	.54	.60	.66	.72	.78	.84	.90	.96	1.02	1.08
5/16"	.29	.58	.65	.73	.80	.87	.94	1.02	1.09	1.16	1.23	1.31
3/8"	.42	.84	.95	1.05	1.16	1.26	1.37	1.47	1.58	1.68	1.79	1.89
1/2"	.55	1.10	1.24	1.38	1.51	1.65	1.79	1.93	2.06	2.20	2.34	2.48
5/8"	.66	1.32	1.49	1.65	1.82	1.98	2.15	2.31	2.48	2.64	2.81	2.97
3/4"	.88	1.76	1.98	2.20	2.42	2.64	2.86	3.08	3.30	3.52	3.74	3.96
7/8"	1.21	2.42	2.72	3.03	3.33	3.63	3.93	4.24	4.54	4.84	5.14	5.45
1"	1.38	2.76	3.11	3.45	3.80	4.14	4.49	4.83	5.18	5.52	5.87	6.21
1-1/4"	1.82	3.64	4.10	4.55	5.01	5.46	5.92	6.37	6.83	7.28	7.74	8.19

E-102-B

LABOR: INCLUDES PREPARATION, DRILLING, SETTING AND SECURING STUD.

7-59

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ANCHOR LAG SCREW SHIELDS
IN BRICK (BY POWER)

BOLT SIZE	HOURS EACH	LABOR COST INSTALLED EACH AT FOLLOWING RATES										
		2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
3/16"	.17	.34	.383	.425	.468	.51	.55	.60	.64	.68	.72	.77
1/4"	.22	.44	.495	.55	.61	.66	.72	.77	.83	.88	.94	.99
5/16"	.22	.44	.495	.55	.61	.66	.72	.77	.83	.88	.94	.99
3/8"	.23	.46	.52	.58	.63	.69	.75	.81	.86	.92	.98	1.04
1/2"	.28	.56	.63	.70	.77	.84	.91	.98	1.05	1.12	1.19	1.26
5/8"	.32	.64	.72	.80	.88	.96	1.04	1.12	1.20	1.28	1.36	1.44
3/4"	.37	.74	.83	.93	1.02	1.11	1.20	1.30	1.39	1.48	1.57	1.67
7/8"	.44	.88	.99	1.10	1.21	1.32	1.43	1.54	1.65	1.76	1.87	1.98
1"	.50	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88	2.00	2.13	2.25
1-1/4"	.63	1.26	1.42	1.58	1.73	1.89	2.05	2.21	2.36	2.52	2.68	2.84
		IN CONCRETE (BY POWER)										
3/16"	.17	.34	.383	.425	.468	.51	.55	.60	.64	.68	.72	.77
1/4"	.22	.44	.495	.55	.61	.66	.72	.77	.83	.88	.94	.99
5/16"	.22	.44	.495	.55	.61	.66	.72	.77	.83	.88	.94	.99
3/8"	.27	.54	.61	.68	.74	.81	.88	.95	1.01	1.08	1.15	1.22
1/2"	.34	.68	.77	.85	.94	1.02	1.11	1.19	1.28	1.36	1.45	1.53
5/8"	.40	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80
3/4"	.44	.88	.99	1.10	1.21	1.32	1.43	1.54	1.65	1.76	1.87	1.98
7/8"	.50	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88	2.00	2.13	2.25
1"	.61	1.22	1.37	1.53	1.68	1.83	1.98	2.14	2.29	2.44	2.59	2.75
1-1/4"	.79	1.58	1.78	1.98	2.17	2.37	2.57	2.77	2.96	3.16	3.36	3.56

E-102-B

LABOR: INCLUDES PREPARATION, DRILLING, SETTING AND SECURING STUD.

7-59

ARMORED BUSHED CABLE
NEW WOOD RESIDENCES

NO. CONDR'S SIZE	HOURS PER C	LABOR COST INSTALLED PER FT. AT FOLLOWING RATES										
		2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
2/14	4.7	.094	.106	.118	.129	.141	.153	.165	.176	.188	.20	.212
3/14	5.1	.102	.115	.128	.14	.153	.166	.179	.191	.204	.217	.23
4/14	5.3	.106	.119	.133	.146	.159	.172	.185	.199	.212	.225	.239
2/12	4.7	.094	.106	.118	.129	.141	.153	.165	.176	.188	.20	.212
3/12	5.1	.102	.115	.128	.14	.153	.166	.179	.191	.204	.217	.23
4/12	6.3	.126	.142	.158	.173	.189	.205	.221	.236	.252	.268	.284
2/10	5.1	.102	.115	.128	.14	.153	.166	.179	.191	.204	.217	.23
3/10	5.5	.110	.124	.138	.151	.165	.179	.193	.206	.22	.234	.248
4/10	6.3	.126	.142	.158	.173	.189	.205	.221	.236	.252	.268	.284
2/8	5.5	.110	.124	.138	.151	.165	.179	.193	.206	.22	.234	.248
3/8	6.3	.126	.142	.158	.173	.189	.205	.221	.236	.252	.268	.284
4/8	7.1	.142	.16	.178	.195	.213	.231	.249	.266	.284	.302	.32
2/6	6.6	.132	.149	.165	.182	.198	.215	.231	.248	.264	.281	.297
3/6	7.4	.148	.167	.185	.204	.222	.241	.259	.278	.296	.315	.333
4/6	8.4	.168	.189	.21	.231	.252	.273	.294	.315	.336	.357	.378
2/4	8.0	.16	.18	.20	.22	.24	.26	.28	.30	.32	.34	.36
3/4	8.8	.176	.198	.22	.242	.264	.286	.308	.33	.352	.374	.396

E-101-B

LABOR: INCLUDES DRILLING, CUTTING, INSTALLING, STRAPPING AND CONNECTING TO BOXES. (NO TAPS OR MAKEUP OF JOINTS).

7-59

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News of the industry

edited for Southern readers

Annual NAED convention held in Chicago

GEORGE W. PROVOST, JR., president, Doubleday-Hill Electric Co., Pittsburgh, Pa., has been elected president of the National Association of Electrical Distributors. Mr. Provost succeeds J. P. Hamblen, president Southern Electric Supply Co., Houston, Texas.

Announcement of Mr. Provost's election as NAED president came at the final session of the 51st annual convention held in Chicago recently. Close to 3,000 persons from every section of the country attended the four-day meeting.

Two new vice-presidents were elected and one re-elected at the convention. The new vice-presidents are B. H. Boatner, president, Westinghouse Electric Supply Co., Pittsburgh, Pa., and C. E. Butler, Jr., president, Butler Electric Co., Inc., St. Louis, Mo. J. A. Meier, Florida Electric Supply, Inc., Tampa, Fla., was re-elected a vice-president.

New members were also elected to the board of governors of NAED. The new board for the coming year will include the following executives of electrical distribution companies in the South and Southwest: J. J. Perry, The Electric Supply Co., Atlanta, Ga.; P. R. Fogleman, Electric Supply and Equipment Co., Inc., Greensboro, N. C.; W. C. Wallis, Southern Supply Co., Jackson, Tenn.; J. W. McCarron, Ahrens and McCarron, Inc., St. Louis, Mo.; Thomas A. Pitt, Weaks Supply Co., Monroe, La.; J. E. Fontaine, Graybar Electric Co., Inc., Atlanta, Ga.; Charles L. Johnson, Charleston Electrical Supply Co., Charleston, W. Va.

100th Medallion Home built in New Orleans

SUCCESSFUL conclusion of a year's Medallion Home campaign by Louisiana Power & Light Company was presaged recently with the completion of the 100th house of a 250 goal for the end of 1959.

Located at 1108 Melody Dr., in suburban New Orleans, the house was built by Felix Caserta, with electric work performed by Marshall Electric Co., 810 North Broad St.

There are 20 circuits in the house: two each for range, separate oven, dryer, central air conditioning. There are the customary two circuits in the kitchen. There are circuits for washer, laundry room, disposal unit, lights, and heater; and six circuits for house lighting and base outlets. Normally variance between ordinary houses and Medallion homes for electrical wiring and lighting fixtures may run from $200 to $400 higher. For the years of added service and satisfaction this is not excessive.

Suburban New Orleans, lying on the east and west bank of the Mississippi river, lies within the Louisiana Power & Light Company territory. Their Medallion program was launched May 1, 1958.

Promotion includes two advertisements monthly in the New Orleans Times-Picayune (the only paper), featuring Medallion Home builders, and advertisements in weekly newspapers throughout LP&L's service area. Direct mail is available through the use of customer lists. The company uses KNOE-TV in Monroe, La., for 30-minute weekly electric kitchen programs. Billboard advertising also is used to promote the Medallion Home program.

There are 14, cooperating builders in the greater New Orleans area, including Mr. Caserta.

When the 100th house is placed on exhibition, LP&L's home service representatives and Harry Wiegel or Bob Jones, builder representatives, will cooperate with the builder in showing it.

Distributor Willard E. Henges (seated, left), president of Graybar Electric Co., and lighting fixture manufacturer Frederick Keller (seated right), president of Thomas Industries, Inc., enjoy an informal meeting during the recent NAED convention in Chicago. Looking on are Arthur E. Swedenborg (left), vice-president of the Benjamin Division of Thomas Industries, and Robert Sayre, vice-president of Graybar.

All-electric buildings act as silent-salesmen

MORE THAN 400 commercial buildings on the Georgia Power Company's lines now are all-electric, Harry T. Yopp, field supervisor, commercial heating and air conditioning, announced this month.

"Plans also are under way", said Mr. Yopp, "For dozens more of these all electric commercial structures to be completed in many areas of the state during coming weeks. Our commercial sales engineers in all the divisions have reported that each new job seems to act as a 'silent salesman' interesting many potential prospects in all-electric installation."

Mr. Yopp pointed out that these 400 buildings are "all-electric in the full sense of the word." Electricity is used for heating, lighting, air conditioning, water heating, and wherever required, cooking.

The buildings range from drug

Wanted: Manuscripts for publication

The editors of Electrical South will welcome contributions from the field for publication. Electrical contractors, consulting electrical engineers, light and power company engineers, and others closely associated with the electrical industry are invited to submit articles, photographs, and drawings relating to important and interesting electrical projects in the South and Southwest.

Articles are wanted in two principal classifications:

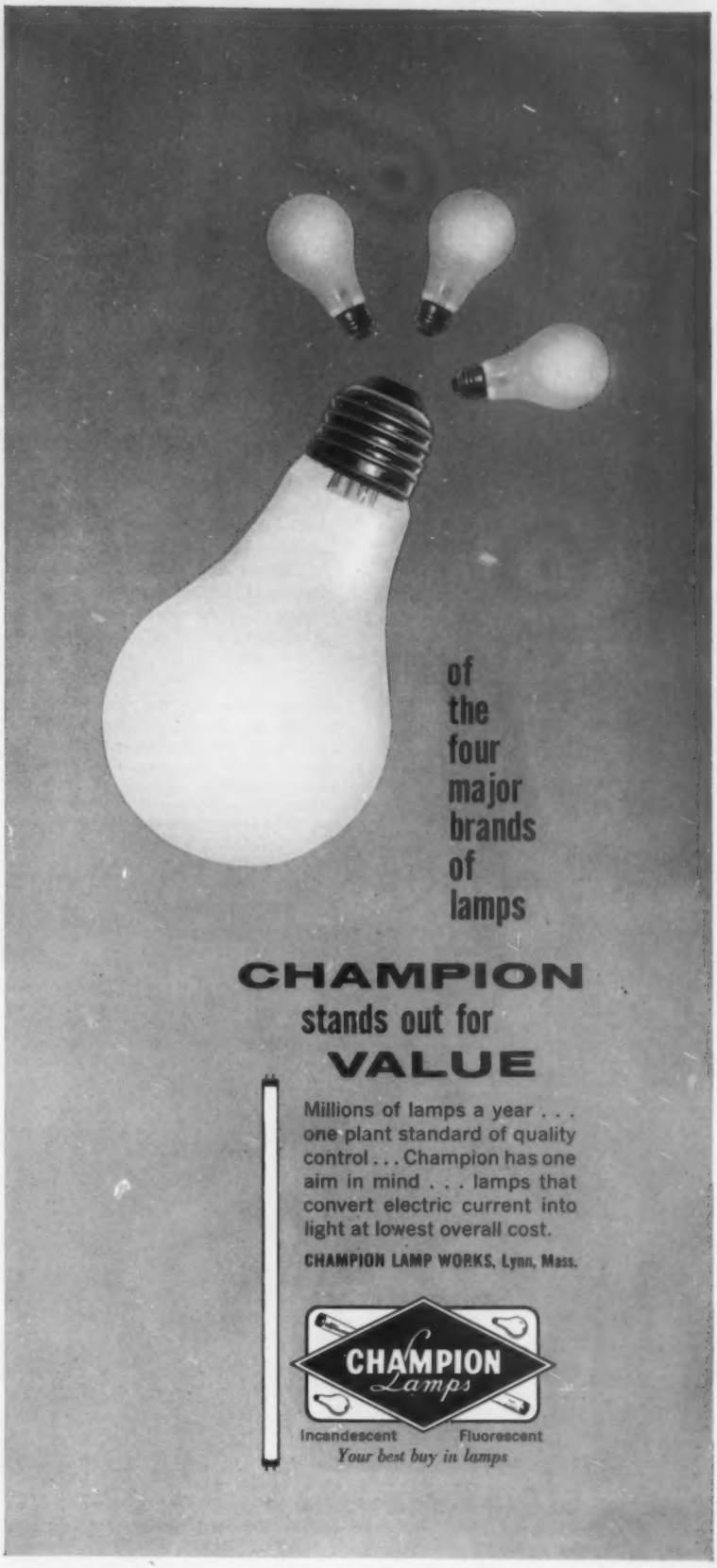
Wiring and Lighting: **Articles on interesting and unusual electrical installations; any phase of electrical contracting such as business promotion, estimating, handling men and materials, etc.**

Utility Engineering: **Articles relating to any phase of transmission, distribution, and metering, including design, installation, testing, and maintenance. These articles should be "by-line" articles carrying the name of a Southern or Southwestern light and power company.**

All articles will be given careful consideration and payment will be made promptly for all material accepted for publication.

Address all communications to the editor:

Electrical South
806 Peachtree,
Atlanta 8, Ga.



stores and small grocery stores to super markets, banks, and multi-storied buildings; and they are located throughout the state.

IAEI Code school held in Texas

OVER 180 registered at the Code School and Panel Discussion Conference, held at Tyler, Texas, recently, by five chapters of the International Association of Electrical Inspectors from Texas, Louisiana, Mississippi.

John L. Walker, chief electrical inspector for the city of Tyler, Texas, was the host to the members and welcomed them to Tyler for the occasion.

Slayton W. Thomas, general chairman of the meeting, selected the panel, to explain or give the answers to problems regarding electrical installations that confronted inspectors and contractors alike during the past year. The panel members were Everett F. Cogan, H. H. Watson, Eustice Soares, Kent Stiner, and Frank Camus, the latter acting as moderator.

All questions were screened by a special committee composed of A. J. Bommer, Underwriters Laboratory of Dallas; Porter Lindsley, Jr., Standard Electric Mfg. Co., of Dallas, and Matt Houreson, inspector in the electrical section of the city of Dallas. The questions continued all through the session, and covered problems appertaining to uses of junction boxes, outer seals at pump stations of gas service stations, resistivity losses on paralled race lines.

H. H. Watson, G-E executive from Bridgeport, explained some of the changes that are being proposed by the national Code committee for the new 1959 Code. His talk was supported by detailed explanations by Frank Stetka, N.F.A. member who assists in compiling the Code.

C. B. Grauer, president of the Southern Section for the IAEI extended an invitation for all those present to attend the conference of similar work, to be held in Jackson, Miss., this fall.

Marshall, Texas, was chosen for the 1960 Code School and Panel Discussion Conference.

NUTONE DISTRICT SALESMEN—Pete Steel, formerly NuTone industrial sales manager, has moved to Atlanta to head the firm's Southeastern sales district. Salesmen in this district are shown here at a recent meeting in Atlanta with L. B. Dreifus, New York, NuTone vice-president and eastern sales manager. Left to right are: (seated) George Smith, North Carolina; L. B. Dreifus; Pete Steel; Howard Garrett, Georgia. (Standing) George Foster, South Carolina; Carroll Esposite, Alabama, and Bill Menchaca, Eastern Tennessee.

IES sets date for technical conference

THE ANNUAL National Technical Conference of the Illuminating Engineering Society will be held from Monday, Sept. 7 through Friday, Sept. 11, 1959, at the Fairmont and Mark Hopkins Hotels, San Francisco, Calif.

George J. Taylor, (vice-president of research and development, Day-Brite Lighting, Inc.,) New York, president of the society, will preside at the opening and business sessions. Eleven technical sessions on new developments in lighting have been scheduled by the host committee of which J. S. Walsh, (Pacific Gas and Electric Co.,) San Francisco, is chairman.

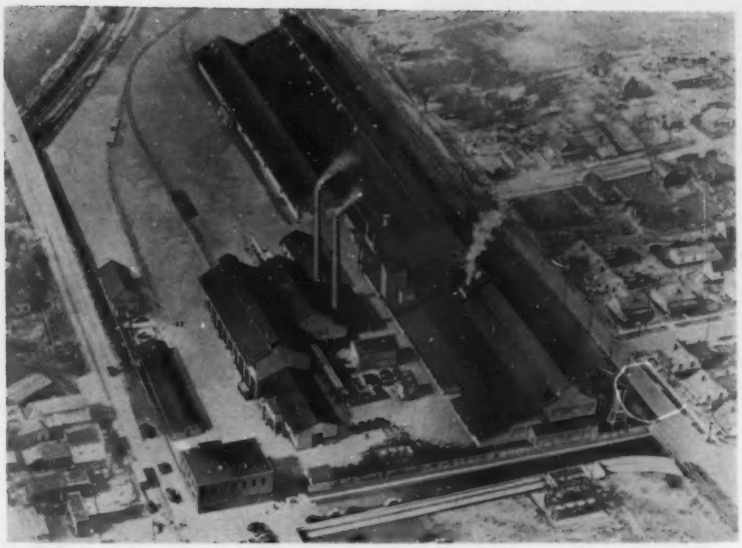
Thirty-page electrical section to run in *Life*

OVER 3½ MILLION reprints of a 30-page special electrical section to appear in the Sept. 14, 1959, issue of *Life* have been ordered in advance by investor-owned electric utilities, members of the Edison Electric Institute. George W. Ousler, vice-president of the Duquesne Light Co., Pittsburgh, Pa., and chairman of EEI's National Electric Living Program Policy Committee made the announcement at a press reception held in the Park Lane Hotel, New York, recently, by *Life* and the other advertising sponsors.

The special electrical section built around the Medallion Home represents one of the largest single advertising investments in magazine history.

EEI advertising will include a 2-page spread devoted to the all-electric laundry; a 2-page spread announcing EEI's Light For Living consumer contest; and three editorial-type pages of advertising on Housepower. These advertisements reflect

Johnnie Walker, chief electrical inspector at Tyler, Texas, was host at the joint meeting of IAEI chapters and is shown here welcoming the assembly to the city of Tyler, Texas.



NEW ANCHOR METALS PLANT—Anchor Metals, Inc. of Hurst, Texas, will serve the Southeastern part of the United States from its new Anniston, Ala., plant. The company designs, manufactures and fabricates steel electrical transmission towers. A division of the company is also operated at Fort Madison, Iowa. The Anniston division is expected to begin production late this summer.

—in fact they serve to launch—the fall activities planned for the National Electric Living Program.

The laundry spread will be a key factor during EEI's Electric Laundry Festival, scheduled for next September and October. The Light For Living ad will kick off nationally the $100,000 Consumer Lighting Contest. The three pages devoted to Housepower will be an important element in the utility industry's fall wiring surge.

Pittsburgh Standard automates production

PITTSBURGH STANDARD Conduit Company, one of the nation's oldest producers of rigid steel electrical conduit, has begun operations in a new $2-million headquarters plant. The plant features a completely integrated, straight-line automatic production facility, enabling Pittsburgh Standard to increase its production capacity by more than 25 per cent.

"The new plant represents what we believe is the most advanced facility in existence today for the production of galvanized electrical conduit," said R. G. McIlroy, president. "It was designed to meet increased demand for our galvanized conduit, and also to meet additional production increases which we anticipate in the near future."

Located on a 16-acre site in Verona, Pennsylvania, near Pittsburgh, the plant contains 110,000 square feet of production space and has an annual rated capacity of 42,000 tons of galvanized rigid steel conduit.

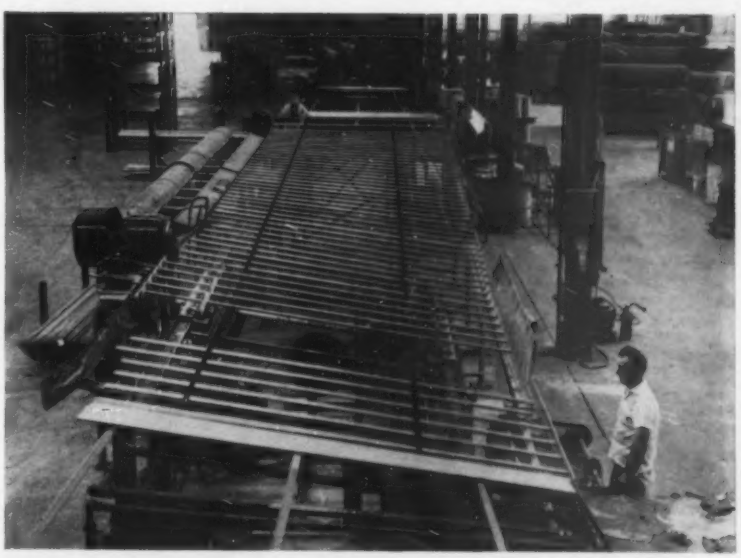
The plant has complete facilities for the production of hot-dip galvanized and electro-galvanized electrical conduit in a full range of sizes from ½-inch through 6-inches in diameter. In addition, its output includes electrical metallic tubing in sizes ranging from ½-inch through 2-inches in diameter, and a complete line of elbows, couplings, nipples, and other fittings.

One of the unique features of the new facility is an automated hot-dip galvanizing unit which accommodates conduit in the company's complete ½-inch through 6-inch diameter range. The unit is a larger-capacity, refined version of the company's hot-dip line at the Morrisville plant, which was used as a pilot operation to develop the technique used in the Verona plant. The technique revolutionized conduit industry's production techniques by hot galvanizing the conduit to gauge, after threading.

Automatic handling of the conduit on the hot-dip production line begins when it enters the plant from outside storage and is fed by conveyor to a hydraulically-operated saw.

Automatic handling continues through the pickling tanks, the pre-flux rinse, the pre-flux application, and immersion in the molten zinc. The conduit then moves by conveyor to a quench tank and a chromic acid bath which combines with the zinc to form a zinc chromate surface on both the exterior and interior walls, greatly increasing the conduit's resistance to salt-spray.

After hot water rinses and drying, the conduit moves automatically to a marking machine and a visual inspection station. At the same time, the inspector screws a coupling on one end, while another man places a color coded protective cap over threads at the other end.



Automatic processing of galvanized conduit and electrical metallic tubing is completed on production lines similar to one shown here at Pittsburgh Standard's new Verona, Pa., plant. This is near end of production line where conduit or tubing pass visual inspection station and end up at point where it is bundled with color-coded tape.

The final operation at the end of the production line consists of automatically bundling the conduit in the ½-inch to 1½-inch sizes with plastic tape, using the same color code as on the thread protectors. From this point, the conduit proceeds to the shipping areas.

New Orleans utility names Andrus president

GERALD L. ANDRUS has been elected president of New Orleans Public Service, Inc., to succeed George S. Dinwiddie, who has been elected chairman of the board. Clayton L. Nairne was elected executive vice-president. Paul F. Hoots was elected a vice-president, and Francis J. Labanca was elected comptroller.

Mr. Andrus was formerly vice-president of the company. He joined Public Service in 1928 as an inventory clerk in the gas department storeroom and served in the accounting and insurance departments until 1934. In that year he became assistant secretary and assistant treasurer and in 1945 was named assistant to the vice-president. He was elected comptroller in 1947 and vice-president in 1952.

Louisiana power company announces appointments

W. O. TURNER, former president of Louisiana Power & Light Co., was elevated to chairman of the board at a company board meeting May 25. Mr. Turner will continue to be the company's chief executive officer.

Elected to replace Mr. Turner as president is G. C. Rawls, former vice-president in charge of operations.

Other officer appointments include: E. A. Rodrigue, former assistant to the president, who was named a vice-president; and John H. Erwin, Jr., who was elected assistant treasurer and assistant secretary.

Officers re-elected by the board are: W. T. Hess, vice-president and chief engineer; A. E. Elliott, vice-president and treasurer; C. L. Osterberger, vice-president and sales manager; W. H. Senyard, vice-president and director of personnel; A. M. Naquin, assistant treasurer and assistant secretary; and L. E. Didier, secretary.

Mr. Turner is a native of Lonoke, Ark. He joined LP&L in 1928, and was made president and general manager in 1939.

Mr. Rawls, the utility firm's new president, is a native of McComb, Miss. He joined LP&L in 1939 as vice-president in charge of operations.

AWARD FOR BOOTH DISPLAY—Glen Arnold, Southeastern representative for Swivelier Co., Inc., New York, stands beside his prize-winning exhibit at the Southeastern Hospital Conference, Atlanta, Ga.

S. C. power company dedicates power plant

CEREMONIES marking the official dedication of the Silas C. McMeekin Steam Electric Generating Station, new giant power maker of the South Carolina Electric and Gas Co., were held recently at the plant which is located about 14 miles northwest of Columbia at Saluda Dam on Lake Murray.

Gov. Ernest F. Hollings delivered the principal address at the dedication which was attended by a group of leaders in business, industry, finance, civic, state, and county affairs. Numerous executives of neighboring power companies were also in attendance.

Meetings announced for coming year

THE SOUTHEASTERN Electric Exchange has announced the schedule for meetings to be held in their organization for the next fiscal year. The Personnel Administration Section Conference will be held at the Grove Park Inn, Asheville, N.C., July 30-31. The Biltmore Hotel, Atlanta, Ga., will be headquarters for the Engineering and Operation Section Conference to be held Oct. 15-16, 1959. Headquarters for the Accounting Section Conference to be held Oct. 22-23, will be the Shoreham Hotel, Washington, D.C. The Sales Conference will be at the Roosevelt Hotel, New Orleans, La., Nov. 16-18, 1959.

Moving into 1960, the Southeastern Electric Exchange has scheduled its Annual Conference for March 21-23 at the Boca Raton Hotel and Club, Boca Raton, Fla. The 1960 Engineering and Operation Section Conference will be held at the Roosevelt Hotel, New Orleans, La., Apr. 7-8.

G. C. Rawls **W. O. Turner** **E. A. Rodrigue**

Dates Ahead

Illuminating Engineering Society, National Technical Conference, Mark Hopkins Hotel, San Francisco, Calif., Sept. 7-11, 1959.

Edison Electric Institute, Meter and Service Committee Meeting, Wentworth - by - the - Sea, Portsmouth, N. H., Sept. 14-16, 1959.

Public Utilities Association of the Virginias, Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va., Sept. 17-20, 1959.

Edison Electric Institute, Transmission and Distribution Committee Meeting, Rice Hotel, Houston, Texas, Oct. 1-2, 1959.

Florida Association of Electrical Contractors, Convention and 7th Annual Trade Show, The Robert Meyer Hotel, Jacksonville, Fla., Oct. 7-10, 1959.

International Association of Electrical Inspectors, Southern Section, 31st Annual Meeting, Heidelberg Hotel, Jackson, Miss., Oct. 12-14, 1959.

American Institute of Electrical Engineers, Fall General Meeting, Chicago, Ill., Oct. 12-16, 1959.

Southeastern Electrical Exchange, Engineering and Operation Section Conference, Biltmore Hotel, Atlanta, Ga., Oct., 15-16, 1959.

Power Distribution Conferer-ence, Dept. of Electrical Engineering, University of Texas, Austin, Texas, Oct. 26-28, 1959.

Southeastern Electric Exchange, Sales Conference, Roosevelt Hotel, New Orleans, La., Nov. 16-18, 1959.

Southeastern Electric Exchange, Annual Conference, Boca Raton Hotel and Club, Boca Raton, Fla., March 21-23, 1960.

Southeastern Electric Exchange, Engineering and Operation Section Conference, Roosevelt Hotel, New Orleans, La., Apr. 7-8, 1960.

. . . by more contractors than any other portable cord

The cord that clicks with contractors is ROYAL . . . and the reasons are many. Made to high standards of quality, and controlled every step of the way under one roof, Royal cords offer the quality characteristics that you look for most in your work — flexibility, durability and dependability.

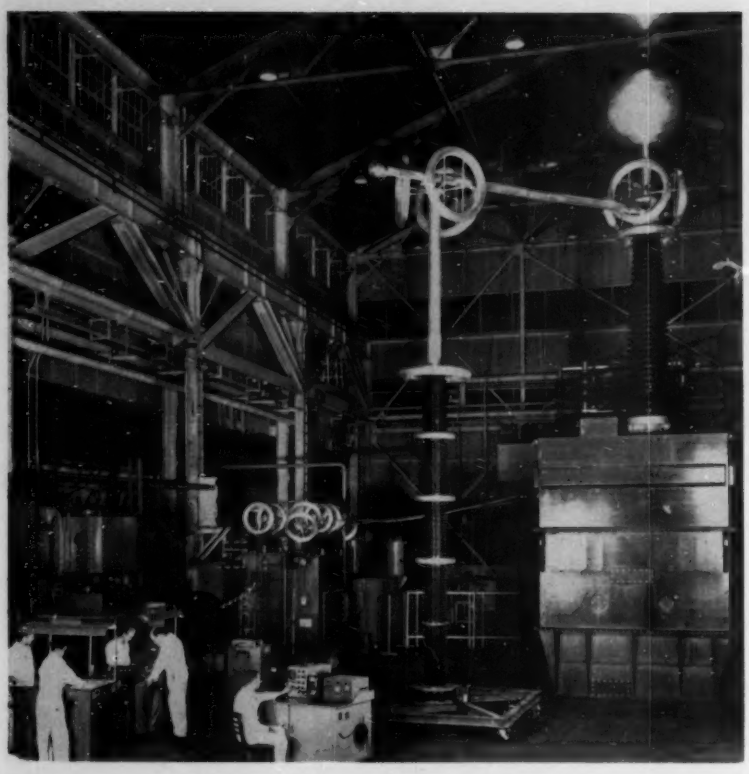
Royal offers the most complete range of types and sizes, too, through your electrical wholesaler; one recognized and respected name on all your flexible cord — Rubber, Neoprene and Plastic Jacketed Portable Cords, Thermostat Cable, Lamp and Fixture Wires, Machine Tool Wires, and heavy duty "POWR-KORD" extensions.

Next time you order cords, specify ROYAL.

Royal Electric Corporation
Pawtucket, Rhode Island

ROYAL ELECTRIC ...an associate of UCC

REPRESENTATIVES:
Cary Chapman & Co., Atlanta—New Orleans—Greensboro—Birmingham
Suckman & Coulters, Inc., Miami
NuRo Company, Houston—Dallas—San Antonio



TESTING APPARATUS—Pennsylvania Transformer Div., McGraw-Edison Company recently installed highly sensitive equipment that permits the detection of the slightest amount of "corona" during transformer insulation tests. The apparatus serves a double purpose: to check present production, and to help plan the higher voltage transformers of the future. The transformer here is a 460,000-volt experimental transformer that is similar to the units to be supplied for Pennsylvania Electric Company's extra-high-voltage transmission line.

Manufacturers appoint new representatives

THE CABELL Electric Co., 422 South Farish St., Jackson, Miss., has been appointed a distributor and agency for various Allis-Chalmers electrical products.

The company will serve as a distributor for Allis-Chalmers motors, control, and transformers, and as an agency for Allis-Chalmers regulators, power transformers, switchgear, unit substations, and circuit breakers.

Area served on these products by Cabell is all of the state of Mississippi except that part north of a line between Columbus, Oxford, and Clarksdale; and East Carroll, Franklin, Tensas, Catahoula, and Concordia, parishes in Louisiana.

* * *

BLACKHAWK INDUSTRIES of Dubuque, Iowa, manufacturers of electrical fittings, have appointed as Florida representatives, Shannon Associates, located at 1204 E. Colonial Dr., Orlando, Fla., and Colin V. Dowds, 1512 N.W. 12th Terrace, Fort Lauderdale, Fla.

* * *

STA-BRITE Fluorescent Manufacturing Co., Miami, Fla., announces the appointment of Electronex Associates, 2904 West Clay St., Richmond 21, Va., as sales representatives for Virginia and North Carolina. Howard A. Curle will work the Virginia area, and R. C. Cooke will serve the North Carolina area.

* * *

THREE NEW representatives in the South and Southwest have been announced by Adalet, Cleveland manufacturer of electrical fittings, fixtures, and electrical housing equipment. They are Hutson Colcock, New Orleans, La.; Jack McAdams Co., Dallas, Texas; and Leo T. McCourt, Baltimore, Md.

* * *

WADSWORTH Electric Manufacturing Co., Inc., has made new sales appointments in the South and Southwest. Appointed sales managers are: Charles H. Porter, Largo, Fla., to serve the Tampa area; George H. Will, Jr., Atlanta, Ga., sales manager for Atlanta; George H. Weitzel, Randallstown, Md., for the Baltimore area; Donald W. Phillips, Kansas City, Mo., to serve the area around that city. Wayne G. Parker and Co., Jenks, Okla., has been named district sales representative for the Tulsa, Okla., district.

* * *

J. A. WEAVER Co., 2110 Howard St., St. Louis, Mo., has appointed two new representatives to handle their line of solderless connectors, ground rods, and service entrance equipment.

The states of North Carolina and South Carolina will be handled by Max I. Miller, P. O. Box 2826, Greensboro, N. C. Robert A. Broan, P. O. Box 1264, Charlottesville, Va., will cover the state of Virginia.

Achievement award presented distributors

AT THE ANNUAL Convention of the National Association of Electrical Distributors, the second annual Thomas Industries "Achievement Award" was presented to more than thirty electrical distributors by Frederick Keller, president of Thomas Industries. The plaque, awarded at a special breakfast, was presented to electrical distributing organizations for outstanding lighting fixture sales and merchandising.

Introduced at the "Awards Breakfast" was a public service motion picture, "The Heavenly Touch of Light," created by Thomas Industries. The fourteen-minute film will be used to show how proper planning can bring dramatic lighting into a home, Keller said. The film will be serviced to television stations, industry associa-

Frederick Keller, left, presents an "Achievement Award" plaque to Milton O. Hollis, Jr., executive vice-president and treasurer of Raybro Electric Supplies, Tampa.

tions, clubs, groups, and organizations across the country.

Holophane announces election of Keller

HOLOPHANE Company, Inc., at a recent director's meeting, announced the election of Clarence C. Keller to the position of executive vice-president. Mr. Keller has been associated

Clarence C. Keller

with Holophone since 1929. He began as a test engineer and advanced steadily to manager of application engineering, sales manager, vice-president in charge of sales and director of the parent company and two subsidiaries.

Brief news notes of manufacturers

CENTURY ELECTRIC Company's Richmond branch office has moved to new quarters. The new branch office's address is: Century Electric Co., 3318 West Cary St., Richmond, Va. Telephone. ELgin 9-2027.

B. G. Biggs is manager of the Century Richmond branch office. Century headquarters are located in St. Louis, Mo.

* * *

JOHN E. MCAULIFFE, chairman of the board of Triangle Conduit and Cable Co., Inc., today announced that the firm is establishing a new Bituminized-Fiber and Plastic Pipe Division in order to expand its operations into the field of bituminized-fiber pipe and conduit.

He simultaneously announced the purchase of a new plant at Landisville, N. J., near Vineland, to which the New Brunswick plastic pipe operations will be shifted, and the manufacture of bituminized-fiber products begun by the end of the year.

* * *

FORMATION of a new consumer division for Silvray Lighting, Inc., of Bound Brook, N. J., was announced today by James M. Gilbert, president. Charles S. Schwarz, formerly vice-

Jet Propel
A LINE THRU A CONDUIT...

PULL WIRE IN *Minutes!*
NO FISH TAPE!
NO SNAKING!

SAVE HOURS WITH A
Jet Line Gun

Invented by experienced electricians
•
In use by thousands of contractors
•
Use in rigid and flexible steel conduits
•
Use in underfloor ducts, cavity wiring structures and underground ducts
•
Goes through floor boxes and C conduiets
•
Saves time, money and wire

Order your Jet Line Gun Kit TODAY!

Ask your distributor or write

Use the Jet Line Gun to shoot a strong nylon line through conduit . . . then draw polyethylene rope through and you're ready to pull wire . . . in minutes, not hours!

A small jet-propelled cartridge does the trick, twisting around ells and bends, up and down as it lays the nylon line in runs up to 300 ft. . . . double this distance when shot from both ends of the run!

The Jet Line system is safe . . . there's no powder charge or explosion . . . and both nylon line and polyethylene rope are non-conductors.

The Jet Line system is accurate. You can't waste wire because the polyethylene rope is marked in feet to measure the exact length of wire you need.

Pat. Pending on Method and Apparatus

Jet Line Gun Company
730 Seigle Street, Charlotte, N. C.

3479

president and general manager of L. & C. Mayers Co., distributors of merchandise for resale and prize-premium use, has been named company director of merchandising and sales promotion and head of the new division.

* * *

MELVIN D. HENRY has joined Anderson Electric Corp., Birmingham, Ala., as sales application engineer for the

Melvin D. Henry

distribution division. Announcement of the new appointment is made by C. E. Bitzer, vice-president and general sales manager.

A PROPOSED MERGER of D. S. Kennedy & Company of Cohasset, Mass., and Anchor Metals, Inc., of Hurst, Texas, was unanimously re-

Clyde F. Mooney

commended by a joint meeting of the boards of directors recently and was scheduled to be submitted for stockholder approval. The merged corporations will continue the name of D. S. Kennedy & Co. Clyde F. Mooney, of Hurst, Texas, will serve as president and chief executive officer.

* * *

OLIVER Electrical Manufacturing Co., Battle Creek, Mich., has announced the addition of new manufacturing facilities which will more than double their present floor space. An additional galvanizing installation will increase Oliver's galvanizing capacity 160 per cent. New fabrication and material handling equipment is also being installed.

Penn-Union advances three in management

C. G. GERLACH, president of Penn-Union Electric Corp., has announced the advancement of three men of the management staff.

Fred T. Conboy, who has been with the company for 24 years, has been named vice-president and assistant to the president.

Lester R. Crane has been appointed vice-president-sales. Formerly Penn-Union sales manager, he joined the company in 1958.

Ralph J. Foster has been promoted to treasurer. He was formerly controller of Penn-Union.

Gardner elected to Woodhead Co. board

DANIEL WOODHEAD COMPANY of Chicago, Ill., electrical manufacturers, has announced the election of George Gardner, of Atlanta, Ga. to its board of directors.

Mr. Gardner resides in Atlanta where for the past six years he has

George Gardner

been in charge of the administration of Whitman Associates, manufacturers representatives covering the Southeast.

"See-Level" kit available from GE

A PORTABLE "See-Level Comparator Kit" just developed by the General Electric Large Lamp Department helps prospective customers to sell themselves that they need more lighting.

The "See-Level Comparator" requires no technical skill to operate or understand. It uses just one impartial

MEET . . .

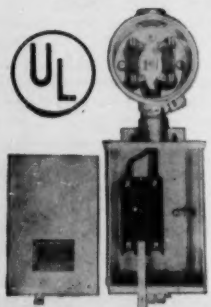
W. J. MILNER

WHO WILL SEE YOU SOON ABOUT

THE NEW TROUBLE-FREE

PIONEER* CURRENT TOTALIZING SECONDARY CIRCUIT BREAKER

*Registered Trade Mark Patented



This especially designed 70/95 Amp. Service Entrance Breaker and Weather proof Enclosure is now being used in the Northern States

- Double pole, common trip, trip free
- Heavy Duty "Elkonite" contacts
- Rugged terminals
- Over 1,000,000 in service
- Sells more KW Hrs. with less Peak Demand
- Promotes better utility-customer Relations by eliminating all unnecessary tripping on unbalanced loads.

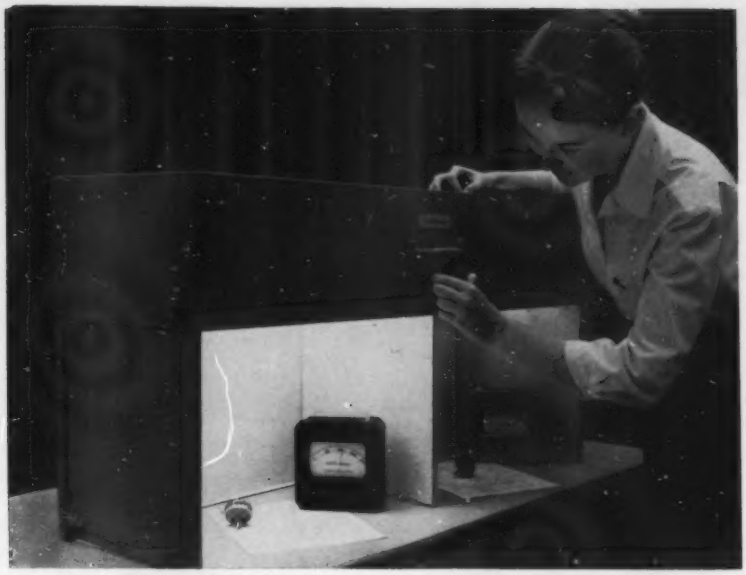
CONVERSION BREAKER UNITS

A special Design for R.E.A. use consisting of *Current Totalizing Breaker, cover, operating handle and complete with all necessary screws.

PIONEER CONTROLS INC.

Division of Pioneer Electric
3627 Peachtree Road, N. E.,
Atlanta, Ga.

Manufacturers of Transformers, Switchgear and Demand Controls



Portable "See-Level Comparator Kit" from General Electric helps the customer convince himself of the need for better lighting in his business establishment. No technical skill is needed to operate it.

measuring device which is always present—the customer's own eyes. The kit is now available through the department's 32 district sales offices across the nation.

About the size and weight of a packed two-suiter, the "See-Level Comparator" sets up in less than a minute in the customer's place of business. It puts at his fingertips a side-by-side comparison of the lighting he needs versus the lighting he has in his plant, office, or store.

Set up, it provides two lighted compartments 13 inches high, 19 inches wide, and 12 inches deep, which can simulate many lighting environments in use today. Operating it, the prospect places a sample of the work done in his business in each compartment. He then varies the lighting level in one compartment to provide the best seeing level, up to 1400 footcandles. Then the lighting in the other compartment is set to the present lighting level of his establishment. The differences are invariably apparant and dramatic.

Anaconda's Ga. plant makes first shipment

ANACONDA Wire and Cable Company has sent its first shipment of wire and cable from its new Watkinsville, Ga., plant. The shipment was highlighted by brief ceremonies recently at which leading officials of Anaconda, the Georgia Power Co., which received the first shipment, and Central of Georgia, the transporting agent, were participants.

D. T. Werner, plant manager, officiated at the ceremonies. D. E. Allen, of New York, Anaconda's vice-president in charge of sales, welcomed the visitors and described Anaconda's world-wide operations.

J. A. Rutledge, of Athens, the railroad's commercial agent, termed the Watkinsville plant "a splendid installation for our entire economy. We feel sure it will be the forerunner of other plants which eventually will locate in this area."

J. F. Pennington, of Atlanta, vice-president and general manager, Georgia Power Co., told Anaconda officials, "We are happy to welcome Anaconda as one of Georgia's newest industrial citizens."

J. L. Tindale, Anaconda's commercial vice-president, accompanied Mr. Allen. D. E. Owens, plant superintendent; E. M. Shockley, sales service manager, and W. O. Lofgren, office manager, all of the Watkinsville plant, aided in the plant tour which followed the ceremonies.

Power company officials present, in addition to Mr. Pennington, were L. M. Shadgett, vice-president and Athens division manager; C. M. Wallace, Jr., vice-president in charge of sales; J. R. Carmichael, manager, purchases and stores; J. L. Botters, assistant purchasing agent; E. A. Yates, Jr., manager, industrial division, and R. E. Rutherford, public relations department.

Men moving up in the industry

EDWIN A. HARRIS, JR. has been appointed products manager for Edwards Company, Inc., it was announced recently by R. L. Kempton,

J. F. Pennington, left, front, the Georgia Power Company's vice-president and general manager, and J. R. Carmichael, center, the company's manager of purchases and stores, confer with Anaconda Wire and Cable Company and Central of Georgia officials as the first carload of copper wire and cable is shipped from Anaconda's new plant at Watkinsville. D. T. Werner, right, front, manager of the Watkinsville plant, checks shipping consignment orders with Mr. Carmichael. Standing are J. A. Rutledge, Central of Georgia commercial agent, left, and D. E. Allen, of New York, Anaconda's vice-president in charge of sales.

NEW CONCEPT
in MOTOR CONTROL BY Furnas Electric

This NEW line of Furnas Electric Magnetic Starters features advanced design to assure superior performance and longer life. It reduces parts inventory and provides quick and easy field modification.

NEW Dual Voltage 110-220 or 220-440 Volt Coil reconnectable on the job. Magnet features just one moving part.

NEW trip-free Thermal Overload Relays with trip indicator—manual or automatic reset. Third relay can be added in the field.

NEW non-tracking Contact Block is impact resistant to withstand severe blows. Front removable contacts.

NEW Modification Kits include push button, selector switch, pilot light and third overload relay.

Write today for Bulletin 14-B1, 1064 McKee Street, Batavia, Illinois

A68

FURNAS ELECTRIC COMPANY
BATAVIA, ILLINOIS

marketing vice-president. Mr. Harris had formerly been assistant to the general sales manager.

In his new position, Mr. Harris will be directly responsible for Edwards' market programs, sales forecasting, and marketing development. In addition, he will continue as a member of the company's market planning committee.

* * *

THE APPOINTMENT of Harold B. Wilde as eastern district sales manager was announced recently by Thomas J. Mellon, vice-president and

Harold B. Wilde

general sales manager of Wesix Electric Heater Co.

As eastern district sales manager Mr. Wilde directs sales operations for Wesix in an area covering 28 states. His headquarters are located at Huntsville, Ala.

* * *

NICHOLAS K. DELANEY has been appointed by Line Material Industries to the new position of product manager - switchgear and capacitor sales. Immediately prior to his new appointment, he had served as product manager—capacitors and regulators. Earle W. Williams, vice-president—marketing, announced that Delaney will now manage sales of both Kyle products and power capacitors, while Albert R. Waehner, director of transformer product sales, will be responsible for regulator sales also.

* * *

WILLIAM C. RUSSELL has been elected a vice-president of Joy Manufacturing Co. Mr. Russell joined Joy in 1955 as general manager of the electrical products division, with headquarters in St. Louis, Mo., and will continue in that position.

* * *

SAMUEL J. SPURGEON has been named manager of the utility engineering division and laboratories at Anderson Electric Corp., Birmingham, Ala., it is announced by John H. Schuler, vice-president and general manager.

Prior to joining Anderson, Mr. Spurgeon for several years was a consulting engineer in Birmingham and the operator of a sales agency specializing in equipment for utilities, manufacturers, and government agencies.

* * *

RAYMOND F. BECKER has been appointed conduit sales manager of Kaiser Aluminum & Chemical Sales, Inc., it was announced today by J. C. Ferguson, general sales manager of the company's Electrical Conductor Division.

Mr. Becker joined Kaiser Aluminum recently. In his new position, he will head up an intensified sales program for aluminum conduit.

* * *

DALE RIEDEL is Holan Corporation's newly-appointed district manager in Kansas City, Mo.

In his new position, Riedel will direct Holan activities in Iowa, Kansas, Nebraska, and Missouri.

Dale Riedel

A former industrial salesman in Cleveland, O., Riedel joined Holan in 1955. He has been engaged in Holan sales work in Ohio, Indiana, and Kentucky.

Fluorescent lamp output improved

A NEW IDEA in fluorescent lamps, termed end-to-end light, plus improvements in light output in all major lines of fluorescent lamps, was announced recently by the Westinghouse Lamp Division, Bloomfield, N. J.

The company has introduced a 40 watt fluorescent lamp which lights all the way to the electrical contact pins. Even the bases on the end of the lamp provide illumination. This is the result of a new translucent plastic material which Westinghouse is using to replace the opaque metal or plastic base.

The new lamps provide a 21 per cent increase in light output over many fluorescent tubes presently in use. The 40 watt rapid start fluorescent lamp produces 3,200 lumens in contrast with the 2,650 rating of many present-day cool white lamps.

EVANS ROOF FLANGES

The top product for top protection! Ask your wholesaler for Evans metal roof flashings—a *trouble-free* service entrance that protects your customer and your name.

Evans Metal Co.
P. O. BOX 13168, STATION K
ATLANTA 24, GEORGIA

SIMPLIFY REPLACEMENT
of Heating Elements for Hot Water Tanks

No matter what size or make of domestic hot water tank — you have just the right element in Vulcan's complete line of flange type and screw bushing type electric immersion heaters. New insulated unit, with built-in resistor, minimizes galvanic action in glass-lined tanks. Band-type or wrap-around heaters are also available.

Vulcan Electric Immersion Elements are furnished complete with either square or round flange (as called for) or threaded bushing according to the replacement requirements; ceramic or other approved insulation; rugged terminal screws. All heaters are tested under 350 lbs. hydrostatic pressure, and meet full requirements of Underwriters Laboratory. Send for catalog and prices.

VULCAN

VULCAN ELECTRIC COMPANY
DANVERS 31, MASS.
Cartridge • Strip • Tubular • Immersion Electric Heaters
Soldering and Branding Irons Solder and Glue Pots

NOW...all ETP fittings are *Chromate Plated* FOR LASTING PERMANENCE!

...AT NO INCREASE IN PRICE!

Concrete tight! Every size connector and coupling up to 2". Why settle for ordinary fittings when ETP gives you all this:

- New tough protection! Sparkling Zinc Chromate over-plating to retard corrosion. Same as tested and approved by the U.S. Government for use in aircraft, rockets and missiles. Salt spray tested.
- Exclusive pre-set, deep-slotted STAKED screws. No backing out for conduit.
- Concrete tight with heaviest gauge wall thickness! Far surpasses U.L. requirements. U.L. file card E24788.
- Precision bevelled edges with extra heavy duty locknut.
- One piece solid tubular steel—cannot open or spread. Sized for uniformity.
- Available in ½", ¾", 1", 1¼" (one screw type) and 1½" and 2" (two screw type) sizes.

CONNECT WITH ETP FOR ECONOMY

Samples and brochure on request

ETP

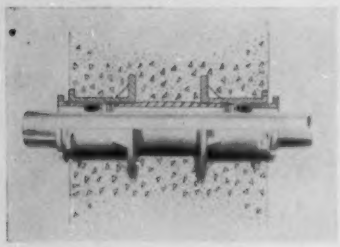
ELECTRIC TUBE PRODUCTS
74-16 Grand Avenue, Maspeth (L.I.), N.Y.

FLORIDA REP: ELECTRA, 3150 N. W. 40th St., Miami, NEwton 3-6379
TEXAS & OKLA. REP: BRENNER ELEC., 305 Velasco, Houston, Texas CA 5-0766

New products

Entrance fittings in 5 types provide watertight seals

A GROUP of five different types of wall and floor entrance fittings which provide watertight seals around conduit or cables as they pass through foundations, floors, or walls of a



building, are now available from O. Z. Electrical Manufacturing Co., Inc., 262 Bond St., Brooklyn, N. Y.

The fittings are available for use with threaded or unthreaded steel conduit, fibre conduit or Transite conduit, or with exposed cables. They will accommodate conduit ranging from ¾" to 6", or cables of varying number and sizes. The conduit (or cables) enter through a gland-type sealing assembly which may be tightened at any time by means of a pressure bushing, to eliminate leaks, if they should develop.

Write P-717 on reply card, page 93.

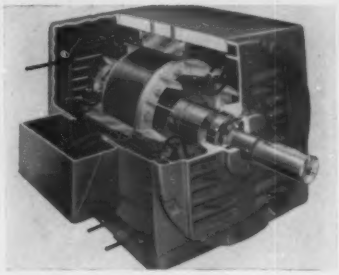
Medium-size motors tailored to specific industry needs

A-C MOTORS, tailored to specific industry needs, are now available from General Electric's Medium A-c Motor and Generator Dept., Schenectady 5, N. Y.

Many different combinations of motor features can now be made available, engineers said, to meet exacting requirements of paper mills, pulp mills, rubber plants, petroleum facilities, and many other industrial areas.

The new "Custom 8000" general line with ratings from 100 to 600 horsepower features a new "square look." This styling trend offers better enclosure and considerable saving in floor space.

Among improvements cited for the new line were adaptability to specific industry needs, faster installation, and



easier accessibility for maintenance. Lower noise levels and greater overall ruggedness were also listed as advantages.

Write P-718 on reply card, page 93.

Fittings available in complete line of hub styles

THE "GEJ" SERIES explosion-proof fittings from Killark Electric Manufacturing Co., Vandeventer and Easton, St. Louis 13, Mo., are available in a complete line of hub styles with

1½" and 2" hubs in non-rusting, non-corroding aluminum alloy. The fittings measure 6-3/16" in diameter and 3½" deep.

They are available with blank flat as well as 3" and 5" deep dome covers for Class I, Group C and D; Class II, Group E, F, and G.

Write P-719 on reply card, page 93.

Exterior fixture provides illumination for wall areas

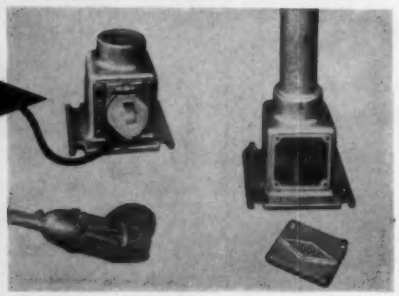
THE PERFECLITE CO., 1457 East 40th St., Cleveland, Ohio, recently introduced a new exterior wall fixture specifically designed for entryways, walkways, and loading areas.

Called the "Pharos", this unit gives an asymmetric light pattern providing good illumination for wall areas, and at the same time, it throws a powerful outward distribution of light 90 degrees from the wall. The heat

For LOW COST Outdoor Lighting...Signs...Signals!

HOPE

METAL-PIPE POLE BASES



A Rugged Support for Threaded Pipe Uprights With Chamber for Splicing and Grounding.

EASY TO FABRICATE—Turn galvanized conduit or pressure pipe (single or coupled lengths) into threaded hub of base, and top-off with the fixture of your choice. Install over embedded anchor bolts and conduit stubs. Splice and ground through generous hand-hole—and the job is done.

Four base sizes permit simple fabrication of poles for a limitless variety of small and large fixture loads at varying elevations.

PROVED IN USE—Attractive installations for lighting parking areas, gas stations, railway platforms, sub-stations, industrial plants and shipping areas, sewage disposal works, pumping stations, schools, churches, hospitals, motels, marinas, resorts. Also as supports for signs and signals. Plain gasketed or 3 pole receptacle cover.

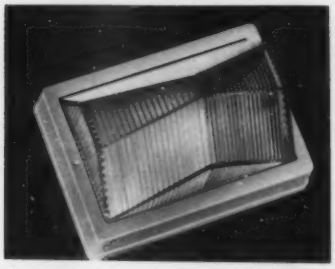
2" — H42200
2½"— H42250
3" — H42300
4" — H42400

Bulletin #25

HOPE ELECTRICAL PRODUCTS CO.
41 Long Avenue, Hillside, N. J. • ELizabeth 4-7837

resistant glass refractor uses accurately calculated prisms on six transmission surfaces and incorporates a silvered glass reflector on the top surface which directs the light downward into useful areas.

The "Pharos" is made of cast aluminum, gasketed and weatherproofed and opens on concealed hinges for easy relamping and easy maintenance. It is rated for 200 watts and utilizes a standard A-25 lamp.



Write P-720 on reply card, page 93.

Pulling elbow sealed against damaging elements

A NEW JIC 90° pulling elbow has been introduced by Appleton Electric Co., 1701 West Wellington, Chicago 13, Ill. The pulling elbow, designed and engineered particularly for use with 90° connections using liquid-tight conduit in limited space, is liquid-tight, weather-proof, and dust-tight. A large cover opening provides easy access for pulling wires in any installation while a solid neoprene gasket gives the best possible seal against damaging elements, liquids, fumes, shavings, and other foreign matter.

Appleton JIC 90°'s are designed for outdoor or indoor connections.

The fitting is made of malleable iron, has a cadmium plate finish and is fitted with a galvanized steel cover for a lifetime of trouble-free service.

The wiring chamber of the JIC 90° has chamfered edges throughout to eliminate the burrs and sharp edges that so frequently damage wires. It is available in ½-inch, ¾-inch, and 1-inch sizes. All sizes have a male threaded end to fit standard conduit hubs of any type junction box.

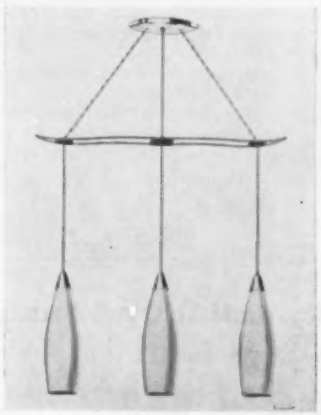
Write P-721 on reply card, page 93.

Simple operation changes fixture cluster grouping

A 3-IN-LINE conversion kit which converts a 3-light cluster into a 3-in-line cluster, is now available from Moe Light Division, Thomas Industries, Inc., 410 S. Third St., Louisville 2, Ky.

A simple operation of assembly will give homeowners an attractive and versatile fixture which has a changeable cluster grouping. A 32-inch walnut spreader can be used with any 3-light cluster, such as the Luxwood, the Cordette line, or the Spiralite cluster.

You can alter the intensity of the light from the cluster. By putting the pendants in line you get a wider distribution of light whereas the cluster gives a more focused and concentrated light.



Write P-722 on reply card, page 93.

Heavy-duty E.M.T. strap comes in two thicknesses

A NEW, more efficient 1-hole heavy-duty E.M.T. strap has been introduced by the Paine Co., Addison, Ill.

The E.M.T. strap, commonly referred to by electricians and contractors as a "half-strap," comes in two thicknesses and can be used for holding conduit, pipe, copper tubing, BX, Greenfield, or non-metallic sheathed cable.

The Paine straps have been designed with ample area around the fastening space for a wrench or power nutter. All sharp corners or burred edges have been eliminated. A special Kwik-klip allows the user to snap the strap securely into position, freeing both hands for fastening. The Kwik release portion of the

ANOTHER NEW

EAGLE

EASY-WIRING TROUBLE-FREE DEVICE

COMBINATION

SINGLE POLE SWITCH

AND

U GROUND RECEPTACLE

SPECIFICATION GRADE

No. 991

Brown & Ivory

Switch Rating
10A-125V "T"
5A-250V

Receptacle Rating
15A-125V
Underwriters Listed

This latest addition to the Eagle combination line incorporates the new U Ground Receptacle to accommodate a 3 wire grounded appliance for maximum safety.

- Will also accept any 2 wire plug.
- Outlet can be wired independently of; or controlled by switch.
- Heavy Phosphor bronze "T" contacts insure life-time satisfaction.
- Heavy duty switch is "T" rated.
- Switch and receptacle on same circuit; common terminal marked "+ line".
- Green color terminal to ground.
- Equipped with 7/8" screws with starting die points and plaster cleaning threads, mounted on straps.
- Wiring diagram on each individual box.

SEND FOR FREE LITERATURE ON EAGLE COMBINATION DEVICES.

SPECIFY EAGLE

ACCEPT NO SUBSTITUTES

"Perfection is not an Accident"

EAGLE ELECTRIC MFG. CO., INC.

LONG ISLAND CITY 1, NEW YORK

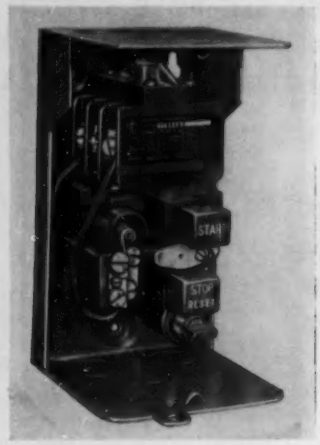
clamp is just high enough to allow easy access of a screw driver or claw hammer.

Write P-723 on reply card, page 93.

"Jog run" accessory optional on new starter

A NEW manual starter rated through 7½ hp., 440-550 volts, a-c and 2 hp., 230 volts, d-c, has been announced by Furnas Electric Co., Batavia, Ill.

Two moving parts replace complex mechanical linkages in the push button mechanism and insure superior life. A direct mechanical acting thermal overload operates independently of the second overload or push button mechanism. This "trip-free" overload unit makes it impossible for the operator to hold the circuit closed against overload.



An exclusive optional feature for this manual starter is a "jog-run" accessory for precise positioning on a-c applications. When in the "jog" position, it allows contact make only while the "start" button is held in the depressed position. Accessory can be factory or field installed.

Write P-724 on reply card, page 93.

Pipe-mounted wireholder reduces inventories

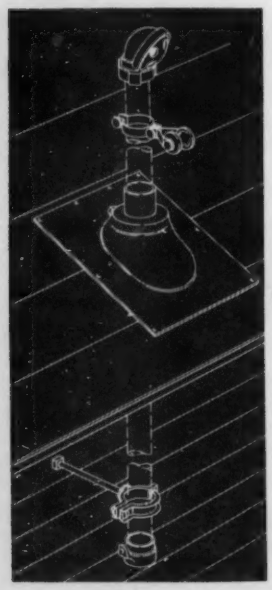
A NEW "UNIVERSAL" pipe mounting wireholder which promises substantial inventory savings for electrical contractors and utilities has been developed by Porcelain Products Co., Carey, Ohio. This new insulator also has many design features which make it easier to install and highly resistant to corrosion.

The porcelain insulator has a large, well-rounded wireway for easier and safer attachment of the conductor, and the insulator is fastened to the steel base by means of a rust-proof copper bail.

All steel parts are heavily galvanized before assembly to eliminate corrosion-causing "acid pockets" where parts are joined together. The bolts are swedged rigidly into the metal base for added convenience during installation and the back bar

is slotted so that the insulator can be clamped to pipe without removal of the factory-installed nuts and lockwashers. The design of the clamp makes it possible to install this wireholder on any size pipe from 1¼" to 2½" without removal or reversal of the back bar.

Write P-725 on reply card, page 93.



Make installations fast, built to last with

M&W SERVICE ENTRANCE MAST KITS

Now, you can have exactly the right fittings for any mast installation...quickly...at lower cost. Just select the M&W Mast Kit to fit your needs. Varied assortments for 1¼", 1½", 2" or 2½" sizes, split-clamp or pipe strap conduit support, make it easy for you to pick the one kit that best suits your requirements. Best of all, M&W Kits cost less than individual fittings.

Kits include all necessary parts for mast installation as illustrated, except conduit. Fittings available separately.

New Catalog 59 gives details and prices on complete line of electrical fittings. Write for your copy today.

M&W Electrical Fittings
The M. & W. ELECTRIC MFG. CO., Inc.
EAST PALESTINE, OHIO

Aerial cable clamp available in two sizes

A NEWLY developed MIF spacer type aerial cable clamp in two sizes, providing a messenger diameter range from 5/16-inch to ⅝-inch, is announced by Pole Hardware Division, Malleable Iron Fittings Co., Branford, Conn. The clamp assembly consists of a pole plate spacer unit

which permits attaching the messenger and cable spacer 4½-inches and 9½-inches respectively from the pole surface.

A curved pole contacting surface of large area provides stability of the spacer unit when mounted on the

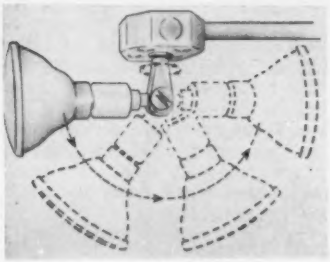
pole. Smooth grooves with generously belled openings eliminate messenger damage. An extra groove is cast into the spacer body to accommodate an optional pole ground wire.

Spacer unit and clamping plate are tough malleable iron castings, hot dip galvanized.

Write P-726 on reply card, page 93.

Heavy duty light swivels completely weatherproof

A LINE of heavy duty swivels, especially engineered for industrial and commercial lighting applications, has been introduced by Ward Engineering, Inc., 6439 San Fernado Rd., Glendale 1, Calif. Listed by Underwriters



Laboratories, this new swivel is completely weatherproof, is sturdily built for extra holding power, and is easy to wire since a straight-through wiring channel is provided. The swivel fits directly into standard conduit boxes for outdoor and garden lighting and is available in six different models featuring various combinations of inside and outside threads.

Write P-727 on reply card, page 93.

Tong ammeter measures fractions of an ampere

COLUMBIA Electric Manufacturing Co., Cleveland 14, Ohio, announces a new Type PB tong test ammeter, primarily designed for measuring

small amounts of direct current, in one-half ampere divisions, from 0 to 10 amperes. In addition, the Type PB can be used to read both a-c and d-c up to 20 amperes.

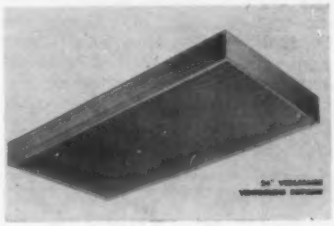
Measurements are taken easily and quickly by clamping the tongs around the electrical conductor, without breaking the circuit or insulation. Jaws can accommodate conductors up to ½-inch in diameter. Two ranges are provided on one dial, 10-0-10 amperes for d-c only and 0-20 amperes for both a-c and d-c. The 10-0-10 d-c scale utilizes an "electrical zero" which is established by use of a magnetic source attached to the instrument.

Write P-728 on reply card, page 93.

Solid or luminous-sided fluorescent units available

UNITS in the fluorescent fixture line of Lighting Products, Inc., Highland Park, Ill., may be surface- or pendant-mounted. All units are either solid or luminous sided and pendant-mounted Versataires are available as either direct or indirect. Mounting may be individual or in continuous lines.

The luminaires are available in 24-, 48-, and 96-inch lengths and 12-, 18-, and 24-inch widths. Versataire



units have over-all depth of four inches.

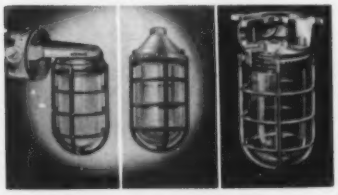
A rigid pre-formed louver frame provided with concealed hinges and locks accommodates six different diffusers. All units are metal, with baked white synthetic enamel finish.

Write P-729 on reply card, page 93.

Line of lighting fixtures prevents premature failures

LAMPS AND LIGHTING installations are reportedly protected against premature failures caused by seeping moisture, rain, ice, sleet, or corrosive fumes by a line of vaportight lighting fixtures announced by Stonco Electric Products Co., Kenilworth, N. J.

Pendant, ceiling, and wall types

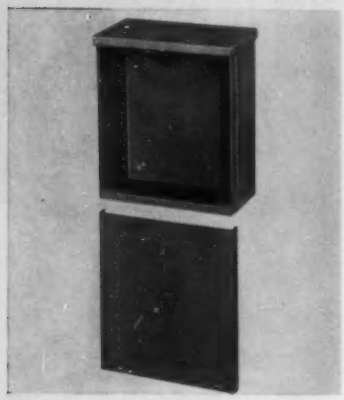


are available in sizes up to 200 watts. Each fixture is individually packaged

with all components for quick installation. Components are heavy-duty, rustproof, corrosion-resistant, aluminum, and die cast for uniformity and interchangeability throughout the entire line. These fixtures also have fewer components than previous models.
Write P-730 on reply card, page 93.

Screw cover boxes protect wiring against weather

RAIN-TIGHT, screw cover boxes, designed to protect wiring from adverse weather, have been added to wiring installation equipment produced by Keystone Mfg. Co., 23328 Sherwood Rd., Warren, Mich. They are suitable for use on junction and pull box applications for either indoor or outdoor use, and are reportedly adaptable to special problem applications.



The boxes feature deep, overhanging flanges on top cover to give protection to wiring. Slip-on removable front covers are designed for quick access and easy installation.

Available in nine standard sizes, ranging from 6 x 4 x 4 inches to 18 x 12 x 6 inches, the code gauge galvanized sheet steel boxes are furnished with standard combination knockouts.
Write P-731 on reply card, page 93.

Electric unit heaters feature enclosed motors

ILG ELECTRIC Ventilating Co., 2850 N. Pulaski Rd., Chicago 41, Ill., has increased capacity in its electric unit heater from 7½ kw to 36 kw with the addition of seven newly designed units, it is announced.

The new electric units feature black-heat type elements which are individually replaceable, new safety design which eliminates bare wires and terminals in the air stream, and Ilg totally enclosed motor with quiet "Q" type fan wheel.

The new units, designed for office, store, and industrial use, are finished in eye-rest green enamel and cover a heating range to 122,832 Btu.
Write P-732 on reply card, page 93.

Sheet steel floor box fully adjustable

THE FULLMAN Manufacturing Co., 1209 Jefferson St., Latrobe, Pa., has developed a new adjustable sheet steel floor box, known as the Number 190 "Tru-Level" series. It was developed for concrete or tile floor, also wooden floors with concrete base. It is a fully adjustable 4-inch galvanized, octagon, watertight box. A threaded adjusting ring, permitting ½-inch height adjustment, in addition to three 2 ½-inch long screw

legs make for quick and easy trueleveling. A rubber collar seals out moisture while protecting the adjusting ring threads. A set screw permits "locking-in" of the top adjustment assembly.

The box-body cover has a 3¼-inch opening, large enough for the hand to fit into the 4-inch octagon box. This enables the inside attachment of conduit, without the necessity of removing the box-body cover.
Write P-733 on reply card, page 93.

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Technical books

for the electrical man

School lighting

"The A-B-See of School Lighting," by Bill F. Jones. Published by Smoot-Holman Co., 321 N. Eucalyptus Ave., Inglewood, Calif., 24 pages, illustrated, $1.00 (Free to persons having responsibility for specifying school lighting).

"One-quarter of our bodily energy is consumed in seeing when visual conditions are good—that is, when our eyes don't have to work very hard." This startling statement is only one of the many facts brought out in this new booklet.

This 24-page booklet not only gives an understandable explanation of the factors involved in producing good light for good sight, but goes into the problems involved in lighting all school areas. The amount of light and quality of light needed to perform various tasks is explained in detail as well as a complete explanation of how these results are to be achieved. Both artificial and natural light are discussed. The booklet gives illustrations of various types of lighting fixtures with a complete chart on their performance. The book which was written with the assistance of the Illuminating Engineering Society, the State of California Bureau of School Planning, and numerous architects and engineers is factual and authoritative.

The booklet is divided into two sections: Classroom Lighting; and Lighting School Areas Other Than Classrooms. The classroom section explains how much light students require for easiest study. It explains the effects of glare and brightness and gives recommended reflectance values.

Digital computers

"Digital Computer Primer," by E. M. McCormick. Published by McGraw-Hill, 327 W. 41st St., New York 36, N. Y., 205 pages, illustrated, $7.50.

This new book provides a concise explanation of the fundamentals of modern digital computers. How they work, what they can do, and their important mathematical, engineering, electronic, and accounting aspects are described in non-specialist's language.

Following an introductory discussion of basic units, essential characteristics, terminology, and sequence of operations, the author gives a detailed coverage of coding, number systems, the logic of computers, and the control, arithmetic, storage, and input-output units. Instructions, programming, and methods for checking accuracy are also treated. The book concentrates exclusively on the general-purpose stored-program automatic digital computer of the general EDPM type, or its scientific equivalent. Specialized machines and applications are not considered.

A chapter on computer logic takes an intuitive, non-mathematical approach to the subject. As simple examples, the book describes the logical organization of a Tick-Tack-Toe playing machine and other game-playing devices. The appendix presents material on the value of representing basic logical operations by means of Boolean algebra.

The author, E. M. McCormick, is Head, Data Assessment Division, U.S. Naval Ordnance Laboratory, Corona, California. He is also a Lecturer in Mathematics at the University of California, Los Angeles.

Marine electronics

"Marine Electronics Handbook," by Leo G. Sands. Published by Howard W. Sams and Co., Inc., 2201 East 46th St., Indianapolis 6, Ind., 264 pages, illustrated, $3.95.

This book gives complete service maintenance information on the various types of electronic equipment in use on both large and small marine craft. Equipment ranging from the radiotelephone and citizens band transceiver to sonar and radar gear is thoroughly covered.

Two special 12-page fold-out maps chart the location of all shore-based transmitting facilities servicing the marine operation.

Many schematics, together with valuable service tips, are also included. One chapter thoroughly outlines operating regulations and procedures for everyone who operates or services marine electronic equipment.

Estimating handbook

"Blue Book of Electrical Estimating," by George L. Sherlock. Published by Estimating Handbooks Associates, 5848 N. Leonard Ave., Chicago 30, Ill., 174 pages, $8.25.

Electrical contractors, as well as everyone else concerned with electrical estimating, will welcome the third edition of this helpful publication—one of the few available in the field of electrical estimating.

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The "Blue Book of Electrical Estimating" covers some 2,000 wiring jobs and contains some 200 completely worked out estimating tabulations, showing the man hours, as well as the labor costs at various hourly rates, for practically every electrical operation that may confront the electrical contractor or industrial electrician in residential, commercial, and industrial electrical wiring.

Perhaps the biggest advantage of this estimating data book over other publications on the same subject is the fact that it eliminates generalities and deals directly with installation costs of specific types of electrical work and operations. All of the data is in tabular form which lists the size of equipment or quantity of materials, and shows the exact portion of an hour required per unit of work, and the per unit labor costs at various hourly rates of pay. Practically every operation required in electrical construction is covered in the tables, such as anchoring lag screw shields; installing boxes, panelboards, and motors; pulling or removing wire in conduit, etc.

A special feature of the 1959 edition of the handbook is an extention of all of the estimating tables to include labor costs of operations on a basis of hourly rates for electricians at $4.00, $4.25, $4.50, as well as the lower hourly rates which had appeared in previous editions. The new tabulations thus cover the highest rates paid to electrical journeymen in this country.

Purchasers of the 1959 edition will receive a new service in the form of supplements issued from time to time over a two year period. The supplements will furnish information on productivity changes in the electrical construction field.

Computing systems

"Digital Computing Systems," by Samuel B. Williams. Published by McGraw-Hill, 327 W. 41st St., New York 36, N.Y., 231 pages, illustrated, $7.75.

This new book gives a broad, technical introduction to the design, construction, and operation of digital computing systems.

After describing the various codes employed to represent the letters and numbers that form data, the author reviews the elements contained in digital computers, discusses the underlying principles of the devices used, and illustrates the devices themselves. The circuitry by which elements are made to perform desired functions is covered, with many examples of typical circuits. Logical design and programming are treated in separate chapters. A brief picture of the application of digital computers to scientific, business, and data handling problems is presented in the final pages.

The book is especially written for readers who are familiar with electrical circuits and apparatus but who have little or no knowledge of mathematics. Each chapter ends with a summary of the main points covered.

Helpful literature

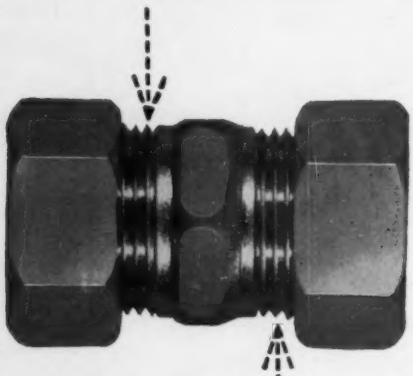
A greatly simplified set of specification and price sheets, printed on durable cards 8½ by 11 inches, and punched for Universal binders, are now available from **Hatfield Wire and Cable Division,** Hillside, N. J. They cover all the essential information needed on **wire and cable:** prices; shipping weights, standard put-ups, shipping lengths, and reel dimensions and weights; diameters, insulation and jacket thicknesses; and voltage ratings and specifications listings.
Write B-734 on reply card, page 93.

Anchor Metals, Inc., of Hurst, Texas, has published an information folder giving details and specifications of its new steel **transmission tower** designed to compete economically against conventional wood H-Frame structures. The light weight towers described will carry 138 kv single circuit transmission lines, and weigh only 4,162 pounds without footings.
Write B-735 on reply card, page 93.

The new **RLM specifications** for incandescent and mercury vapor uplight porcelain enamel and aluminum high mounting units, "all-white" incandescent specs, and many upward revisions in specifications for industrial fluorescent fixtures are included in the 1959 edition RLM Specifications Book just published by **RLM Standards Institute,** 326 W. Madison Street, Chicago 6, Ill.
Write B-736 on reply card, page 93.

A new publication on powermaster **substation transformers**—GEA-5452A—describes GE's new substation transformers rated single-phase, 500 kva and below, 15 kv and below, for use in distribution and industrial substations. This bulletin, available from **General Electric Co.,** Schenectady 5, N. Y., illustrates exterior and interior features and tells how the new transformers can increase the kva capacity of mounting pads as well as reduce operating and maintenance costs.
Write B-737 on reply card, page 93.

Conduflor Corp., Box 2748 Cleveland 11, Ohio, has issued an eight-page brochure detailing design and application methods for Conduflor's **headerduct system** for power, com-



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munication, and signal distribution. In addition advantages of the Conduflor headerduct system to the architect, electrical engineer, electrical contractor, and building owner are reported.
Write B-738 on reply card, page 93.

A new bulletin, just published by **Insulation Manufacturers Corp.,** 565 W. Washington Blvd., Chicago, Ill., tells all about the new Inmanco Mylar **polyester film wedges.** Bulletin No. 29 lists the specific advantages, such as the tough, space-saving, thin-wall, hollow shape; high dielectric strength; moisture and chemical resistance; and others. Charts are included on the typical electrical and physical properties of the Mylar film.
Write B-739 on reply card, page 93.

Hook-operated **disconnect switches** are described in bulletin Number PSE8, released by **Line Material Industries,** Milwaukee 1, Wis. Design features of the Type PES, single-blade, single-throw switch; the Type PED, single-blade, double-throw switch; and the Type PET, tandem-blade, single-throw switch are illustrated. Dimensional and mounting details are outlined.
Write B-740 on reply card, Page 93.

New 64-page Catalog 60 issued by **Edwin L. Wiegand Company,** 7500 Thomas Blvd., Pittsburgh 8, Pa., illustrates the complete line of Chromalox **electric process heaters** and describes their many uses. Over 15,000 types of heaters are available to fit most heating needs. Also included is a comprehensive technical section to aid in accurate calculation of heating requirements.
Write B-741 on reply card, page 93.

A complete catalog of **clamps and straps,** detailing specification data and essential ordering information such as pieces per box and carton, has been issued by **Victor Specialties,** 775 Main St., New Rochelle, N.Y. The line includes clamps and straps for armored cable, nonmetallic sheathed cable, thin wall conduit, heavy wall conduit, and service entrance cable in a wide range of types and sizes.
Write B-742 on reply card, page 93.

An application manual covering the Jetapower **engine-generators** manufactured by **Jeta, Inc.,** 957 Saw Mill River Rd., Yonkers 2, N.Y., lists essential information needed for designing an application. In addition it includes a guide for writing specifications for such units, lists the numerous optional accessories available, and provides information on the manufacturer's production and testing facilities.
Write B-743 on reply card, page 93.

ACCO **aluminized steel wire** and wire products—steel core wires for ACSR; steel strand guy wire; overhead ground wire; tie wire; messenger wire; telephone wire; chain link fabric and barbed wire—for industrial, institutional, and residential uses have been graphically presented in a 6-page folder issued by the **Page Steel and Wire Division,** American Chain & Cable Company, Inc., Monessen, Pa. It lists the properties and applications of these widely diversified hot-dip, aluminum coated wires and wire products which combine the strength of steel and the corrosion resistance of aluminum in one end product.
Write B-744 on reply card, page 93.

Ainsworth Lighting, Inc., 38-10 29th St., Long Island City 1, N.Y., has announced that a new catalog featuring lower prices on a number of their products has been published. The 12-page loose leaf information file provides descriptions of 6 types of **fluorescent fixtures** and also many incandescent units.
Write B-745 on reply card, page 93.

An illustrated, easy-to-read, 20-page catalog, describing their Inmanco standard packaged **slot insulations,** formed fibre and shaped wood wedges, and formed polyester film wedges, with selection guides and ordering data, is available from **Insulation Manufacturers Corp.,** 565 West Washington Blvd., Chicago 6, Ill.
Write B-746 on reply card, page 93.

A survey of the techniques of **welding aluminum** using Air Reduction's Aircomatic (gas-shielded metal-arc) and Heliweld (tungsten-inert-gas) processes has been issued by **Air Reduction Sales Co.,** 150 E. 42nd St., New York 17, N.Y. It is a 120-page spiral bound book entitled "Aircomatic and Heliwelding of Aluminum."
Write B-747 on reply card, page 93.

A kit called "Adjustable-Speed Drive Equipment for Extruding" has been issued by **General Electric Co.,** Schenectady 5, N.Y. The kit features **drive selection information** to help determine the drive that is most correct and economically suited for a particular application.
Write B-748 on reply card, page 93.

Anaconda Wire & Cable Co., 25 Broadway, New York 4, N.Y., announces publication of Bulletin DM 5844. It gives technical data on Anaconda's thermoplastic all-purpose **control cable** with polyethylene insulation, double Densheath (PVC) jackets.
Write B-749 on reply card, page 93.

A new handbook and catalog of Spang **conduit and fittings** has been issued by **The National Supply Co.,** Two Gateway Center, Pittsburgh, Pa. The new edition, Bulletin No. 485, features brief illustrated descriptions of many installations in all kinds of buildings, including industrial plants,

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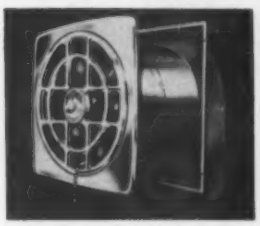

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Write B-750 on reply card, page 93.

A handy 6-page **capacitor selection guide**—GED-3687—gives tables for choosing proper ratings of switched shunt capacitors for modern induction motors. Tables cover motors of all standard types, enclosures, and nominal speeds, 220 to 4000 volts, 2 to 500 hp. The folder is available from **General Electric Co.**, Schenectady 5, N.Y.
Write B-751 on reply card, page 93.

A complete catalog containing detailed information for selecting and ordering 110 different products is now available from **Martindale Electric Co.**, 1312 Hird Ave., Cleveland 7, Ohio. Designated Catalog No. 32, it includes metal-working saws, rotary files and burs, test instruments, safety equipment, and many **electrical and maintenance items.**
Write B-752 on reply card, page 93.

A new 6-page bulletin describing their new "Bonus Line" ballasts for all **outdoor lighting** uses has been announced by **General Electric**, Schenectady 5, N. Y. Application data, performance and construction features are included.
Write B-753 on reply card, page 93.

Relay conference

(Continued from page 80)

small distribution bank where all of the capacitors in each phase leg are connected in parallel.

In the larger banks, and especially in the higher voltage banks where more than one series group of capacitors is required, the capacitors are generally individually fused. In this case, a fuse cutout is used for each capacitor unit.

There are several basic principles, he said, which must be observed in the selection of a fuse for capacitor application.

The fuse must be capable of continuously carrying 135% of the rated capacitor current.

It must have sufficient interrupting capacity to handle successfully the available fault current.

It must withstand, without damage, the normal transient current during bank energizing and deenergizing. Similarly, it must withstand the unit discharge current during a terminal-to-terminal short.

For ungrounded wye banks, where maximum fault current is limited to three times normal line current, the fuse must clear within 5 minutes at 95% of available fault current.

For effective capacitor protection, maximum fault current should not exceed 5,000 amperes through a shorted 50 kilovar capacitor unit or 4,000 amperes through a shorted 25 kilovar unit.

The time, current clearing characteristics of the fuse links must coordinate with the tank rupture curve of the capacitor unit.

Mr. Stone's discussion included protection with unbalance detectors and methods of detecting unbalances. He presented a set of unbalance calculations for several connection configurations.

Other papers presented at the conference included the following: "Discussion of excitation, stability, and loss of field protection of generating units," by Jack Davey, Louisiana Power and Light Co., New Orleans; "The lead acid battery and its application of relay control and switchgear," by Harrison Taylor, C & D Batteries, Inc., Conshohocken, Pa.; "Protecting a large cross-compounded steam tur-

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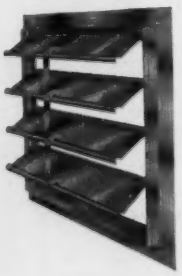

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bine generator," by Lucien E. Owen, Tennessee Valley Authority, Chattanooga.

Compensation

(Continued from page 64)

between line current and control voltage because the current is in phase with line to neutral voltage, and the control voltage is phase to phase. This is shown in Fig. 4. Since this phase shift is present, the compensator settings as previously calculated must be corrected to provide proper compensation. As Fig. 4 shows, one regulator has a current that lags the line voltage while the other has a current that leads.

To determine which unit has the lagging current, regulator controls are set to the same voltage level. All of the reactance compensation is turned in on each control and the units are placed in automatic operation. The regulator which raises its voltage is the unit in which the current lags the line voltage. During this test, the regulators should be carrying sufficient load to give a good positive indication.

The following equations are used to calculate the new compensator settings.

$$R_1 = .866R - .5X$$
$$X_1 = .866X + .5R$$
$$R_2 = .866R + .5X$$
$$X_2 = .866X - .5R$$

where R and X are the compensator settings previously calculated, R_1 and X_1 are new settings for the regulator in which current lags the voltage, and R_2 and X_2 are the new settings for the regulator in which current leads the voltage.

Value of R_1, X_1, R_2 and X_2 are available in manufacturers user's manuals. When values calculated from the above equation are negative, the compensator polarity switch on the regulator control is turned to the appropriate position.

When three single-phase regulators are connected in closed delta, the regulator current either leads or lags the regulator voltage by 30 degrees, depending on the phase rotation. If the current is lagging, the values of R_1 and X_1 from the above equations are used on all three regulators and if the current is leading, the R_2 and X_2 values are used on all three regulators.

If shunt capacitors are being used between the regulator and the load center, the voltage level must be adjusted to obtain proper compensation. The following equation is used to obtain the voltage level increase.

$$\text{Voltage level increase} = \text{Reactance setting} \times \frac{\text{(Capacitor current)}}{\text{(Primary rating of regulator CT)}} \times \frac{b}{a+b}$$

where a is the distance from the regulator to the capacitor bank, and b is the distance from the capacitor bank to the load center.

If the capacitors are installed ahead of the regulator, or if they are installed at or beyond the load center, no correction is required.

Applying compensation wisely

There are limitations which must be considered in applying compensation. The basic idea of compensation is to provide a constant voltage regardless of load at some point on the feeder. This means the voltage at the output terminals of the regulator will vary with load. Care must be taken to make sure that this voltage is not too high. Excessive compensation, resulting in high regulator output voltage, can damage customer equipment, if such equipment is close to the regulator.

The procedure outlined above for calculating values of compensation is exact. However, the necessary information is sometimes difficult to obtain with great accuracy and the results on the actual system may not be exact. It is good practice to check the load center voltage after the regulators have been adjusted and placed in service. If the voltage is incorrect, the resistance and reactance settings may be changed, while maintaining the calculated ratio until the correct voltage is obtained at the load center. A two-way radio may be utilized in making these corrections.

Calculation of compensator settings for voltage regulators is not extremely complicated once the necessary circuit factors are determined. A line drop compensator work sheet can be used to calculate compensator settings. These sheets insure a uniform method for each calculation.

Correct compensation will give more economical system operation and customer satisfaction. Since both factors can mean increased revenue, proper use of compensation should be seriously considered.

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Lightning arresters

(Continued from page 56)

to a certain voltage and it must dissipate the energy. Work along these lines is not completed, but it looks quite certain that some high-voltage arresters rated 3 kv will handle at least 8,000 watt-seconds. A 270-kv arrester would then handle 90 times as much energy (because it contains 90 times as much material); this would be 720,000 watt-seconds, or 720 kilowatt-seconds. With reasonably good breakers, it would discharge without great strain a 345-kv line about 175-200 miles long.

Classifications of arresters

There are four classifications of arresters: station, intermediate (line), distribution, and secondary. The applications for distribution and secondary class arresters are obvious. The question frequently arises whether to use station or intermediate arresters. This is not an easy one to answer glibly, except in the high-voltage ranges, 145 kv and above.

The station arrester has lower discharge voltages, is more durable, can handle more energy, and has effective pressure relief. Against this the intermediate arrester has the advantage of lower investment. Resolution of the question is largely economic. If the highest degree of protection is desired, the station class is the answer.

Plug-in busway

(Continued from page 21)

of accomplishing the objective in the manner that any contractor strives for in undertaking a job: this one was completed competently, profitably, and to the complete satisfaction of the customer.

Code discussion

(Continued from page 97)

it becomes overheated. This heating and cooling of alternate wires creates loose connections which aggravate the condition still further.

If, however, care is exercised and a workmanlike job is installed, a great saving in copper can be realized by the paralleling of conductors. Precaution must be used to avoid using too many conductors in parallel which would present an unmanagable number of terminals in the space usually provided for such connections.

Current carrying capacities

As an example of the advantage of parallel conductors in respect to current-carrying capacities, a 3-phase, 4-wire load of 500 amperes requiring a neutral capacity of 410 amperes could be arranged in either of the following ways (and many other ways) using Type RHW conductors and separate raceways for each set of conductors:

1 set of 3-900 MCM and 1-600 MCM in 1-5″ conduit resulting in phase capacity of 520 amps and neutral capacity of 420 amps.

2 sets of 6-350 MCM and 2-4/0 in 2-3″ conduits resulting in phase capacity of 510 amps and neutral capacity of 460 amps.

3 sets of 9-2/0 and 3-1/0 in 3-2½″ conduits resulting in a phase capacity of 525 amps and neutral capacity of 450 amps.

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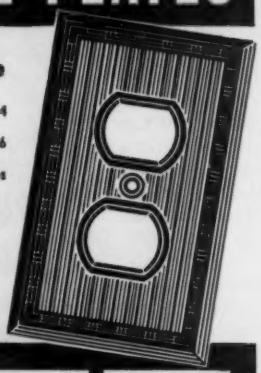

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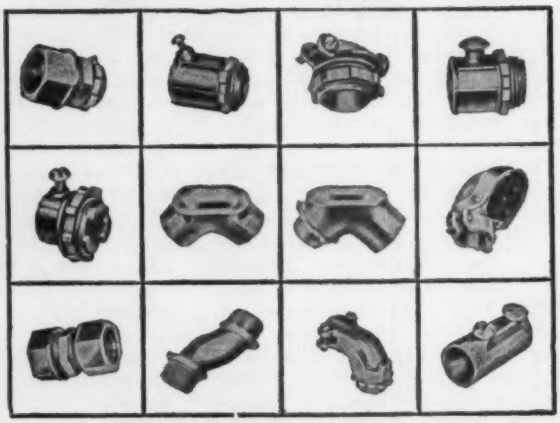

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By contrast, one set of 2,000,000 CM Type RHW conductors has a capacity of only 665 amperes. Any contractor could compare the costs of the three sample arrangements of one set of conductors with a single large raceway, two smaller sets with two smaller raceways, or three sets of still smaller conductors with three raceways and take his choice. His choice would seldom be the single set with one large raceway.

In the next issue, we will begin discussions of the various wiring systems recognized by the Code.

Answers to Code test questions: (1. **T** section 3102) (2. **T** section 3101) (3. **F** section 3102) (4. **F** section 3102-b) (5. **F** section 3104) (6. **c** section 3103) (7. **b** section 3105) (8. **c** Note 4-a following tables 1 and 2) (9. **a** Note 4-a following tables 1 and 2) (10. **a** Note in tables 1 and 2).

Flexible lighting

(Continued from page 29)

engineers of Birmingham, worked with Alabama Power Company lighting engineers. The trough-type fixtures are spaced six feet on center for a floor to ceiling space that is nine feet. The resulting 75 footcandles is considered visually satisfying for the variety of work tasks and for good employee relations.

For the executive type offices these rows of light permit flexibility of arrangement while delivering soft diffused illumination throughout the enclosed space. Likewise the movable partitions that separate a variety of work spaces can be rearranged without affecting lighting standards. The soft colors of ceiling, walls, and partitions blend with the lighting for interest and eye appeal.

All lighting is fed from 2,000 ampere, low-impedance, 4-wire, Square D busway. Two 1,000 ampere, 3-phase power busways extend all the way up the building. The main feeders are parallel 2500 ampere, 4-wire busway, 120/208 volts. Since this is the second addition to the main office building of the Alabama Power Company, there are now three switchboards, electrically interlocked with controls from the No. 2 board so that one operator can man all three. All conduits run straight up the building with no offsets.

A time and cost saving factor for the contractor was furnishing a layout so that the Square D factory could drill panels before they shipped them. The installations include 38 lighting panels and four power distribution panels.

IES conference

(Continued from page 27)

dressing the audience directly, practice what you preach. Take a real good look at your home lighting. Don't be like some interior decorators I know. I listen to them preach, then get into their homes, and if I don't find in their homes what they preach, I lose confidence in them."

C. L. Crouch, the IES technical director, had the subject, "The Lighting of Space for Living," but devoted much of his comments to the headquarters office of IES.

He said a portable version of the visual task evaluator should be available by fall, added there are 56 established tasks that are evaluated, but said these may be expanded by the committee on RQQ. He asked that members send in tasks for consideration by Dr. Blackwell.

W. F. Wilson appeared on the program in the place of one of his staff members, Howard W. Stenz, whose presence was required elsewhere. Wilson is president of the Wide-Lite Corp., Houston, and his subject was "Area Lighting with Mercury Lamps."

He said the virtues of mercury vapor as a light source, with high efficiency and long life, have long been appreciated. "However," he continued, "it was not until introduction of the color-corrected or, as some designate it, color improved mercury vapor lamp that the benefits of this light source could be extended to lighting areas of all types.

"The range of mercury vapor lamp sizes—100 to 1,000-watts means that the areas to be lighted may also vary greatly in size, from huge parking lots down to garden spots. Truly, the lamp manufacturers have given a challenge to the floodlight designers to cooperatively provide a wide variety of tools for the lighting engineer's use in adequately and efficiently illuminating areas of all types.

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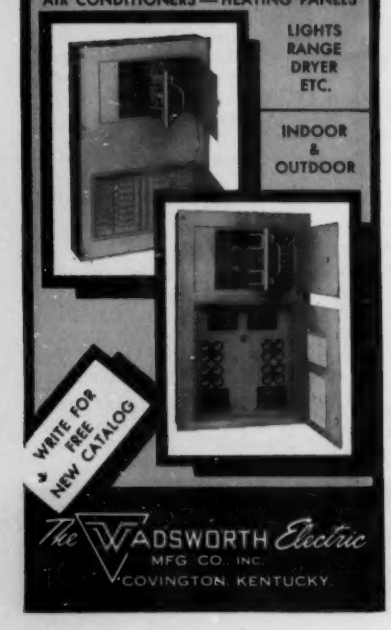

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that should be mentioned, however. That is the determination as to whether vertical, horizontal, or beam foot candles should be the criterion for a given installation. This is quite a controversial subject but, with controlled and adjustable aiming of perimeter lighting over large areas, the ability to discern obstacles to foot traffic would appear to be more important than horizontal illumination per se.

"It may be well to mention that one of the shortcomings of mercury vapor lamps is the length of time necessary for them to restrike and return to full brilliance after a current outage. The electrical utilities have greatly extended their use of feeder and circuit regulation equipment and the incidence of circuit interruptions is far less than it was a few years back. This problem, therefore, may be very greatly discounted.

"The commercial and industrial applications of the small mercury lamps in area lighting are practically limitless once the user becomes acquainted with the virtues inherent in the lamp design. In thus emphasizing the possibilities of the smaller lamps we do not mean to detract from the larger rated lamps, but the comparatively recent introduction of the 100, 175, and 250 watt lamps has permitted only limited exploration of their many potential applications."

Ballasts in lighting

To conclude the speaking program, E. C. Pauly discussed "Ballasts in Lighting Applications." He is manager of the ballast division of GE and his rapid-fire delivery left no question about his mastery of the subject.

"If a ballast engineer is looking into the future of ballasts," he said, "he is a crystal-gazer, but at the plant he is called a 'marketing trend forecaster.'

"The first ballast appeared in 1939. Now it has been reduced in size by 30 per cent and it is 60 per cent lighter and, last but not least, the cost over the past 20 years has been reduced by 50 per cent. This is real progress.

"Today we use better copper, better insulation material, better silicon steel for more efficiency even with lower cost. Basically the type of circuit used has had much improvement and there is a considerable amount of standardization. Lamp applications have been broadened so as to present a real challenge to the ballast engineer."

Pauly expressed the conviction that rapid-start has the brightest future.

"If you were to set up basic specifications for ballast you would find the most important are size and shape, weight, performance, cost, noise, and heating. Another area of bright promise and more freedom of design is frequency conversion. In fact, products of the future will offer a great deal of freedom to the designer. And with their crystal-gazing and investments, manufacturers will have a product in the market place as this trend takes place."

Successful conference

In his closing remarks, Regional Vice-President Deck called it a highly successful conference. For the next three years the conference will rotate from Corpus Christi in 1960 to Oklahoma City to Dallas. Registration at Houston was announced as 180.

In addition to special events for the ladies and golf for men, there were three mass entertainment features. These were a boat trip on the Houston ship channel, the president's reception, and the annual dinner dance.

Wiring profits

(Continued from page 28)

got to estimate only about three jobs in every 10 calls."

When jobs are called in, they are recorded on a job form, scheduled, and listed for the day they are to be carried out, in accordance with customer request. Jobs are then assigned to electricians, under truck number, and a listing made by truck number as an office reference for each job assigned to that truck and mechanic for the day. Each mechanic then copies off the jobs he is to handle. This gives the office, at a glance, the location and the jobs being handled by every truck throughout the day.

"We are constantly changing our forms, and we still have not come up with a form that fully satisfies us. We know at any time how many jobs truck #6 may be handling, what those jobs are, and where to locate the truck, if the mechanic is to handle another job in his vicinity," explained Klein.

What has impressed other electrical contractors at A/C Electric is the warehouse layout and plan of stock bins. A full-time manager is in charge of the 25 x 75-ft. stockroom, which Klein describes

as a small supply house, constantly rearranged for greater efficiency.

Small items are placed in 36-in. and 48-in.-wide bins, big items, on shelves. Bulbs are placed in the front of the stockroom because they are sold over the counter, and this location is most convenient.

Heavy items are placed in the rear of the stockroom, near the back door, for easier handling. The metal or wood bins, drawers, and shelves are clearly marked with name and size of items. The floor is covered with gray asphalt tile for durability, ease of cleaning, and neat appearance.

Place for every item

"In planning the stockroom, I had one underlying purpose: every item should have a place, and be *in* its place. Nothing must stand around on the floor. Aisles must be clear, passage easy, with everything located so as to cut down on time, steps, and effort," explained Klein.

A/C Electric keeps a perpetual inventory on material like cable, conduit, boxes and switches for buying purposes, the firm tries to follow the market on prospective pricing through newspaper and other sources. When it is advisable to buy in a rising market, materials are bought for three- and six-month periods. On other depleted materials, lists are made by the stock manager and submitted to Klein for approval before being reordered.

"In layout, the supply manager groups together related items. Bulbs and fixtures may be found together, plugs and switches, wire and cable, and boxes and conduits. It would be sheer loss of time to look for a switch in one place and then go down the aisle looking for plugs," he added.

Slimline fluorescent fixtures provide high illumination, lighting every corner of the stockroom. With every bin and shelf well-illuminated, there is no groveling in darkness for concealed and dust-collecting parts.

Tool check-out board

A tool-location blackboard indicates, by number, whether a mechanic has a particular tool or whether it is to be found in the warehouse. Tools are checked in and out for better control.

Continued Klein:

"We are continuing to do more commercial lighting and less residential. Specialized lighting for parking lots, stores, and homes turns up more frequently now. Dramatized lighting, to suit individual situations and adapted to special purposes for singular effects, provides an opportunity for a contractor's ingenuity and skill in carrying out a job satisfactory to the customer. The more efficient our organization and the better control we have of materials, the better job we can carry out at a price more satisfying to the customer."

Contractors tell how

(Continued from page 34)

we are furthering the cause of adequate wiring as a whole, since we can upgrade a skimpy patch job to a higher-priced deal, give the customer a better job, and make a better profit for ourselves.

It is in this fashion that we land $25 and $50 jobs, and upgrade such work as an apartment remodeling chore which started out as a small job and wound up with a $900 ticket. The customer paid $300 down; we got full list price on all materials and labor; plus 10 per cent or $66 extra for carrying the paper. On a $300 job we will accept $50 down—on the same terms.

We have about $2500 on our books right now, which is not an inconsiderable sum for a small contractor. But it is all being liquidated, and when an account gets paid up, we have made a friend and a future booster and customer.

Washington report

(Continued from page 19)

ployees referred by the local union and the union could remove employees issued temporary work cards clearly an exclusive hiring hall arrangement existed.

Rasbury also found that Article II Section 9 of Satchwell's agreement with Local 177 at Jacksonville forced it to abide by Local 508's rules while working at Brunswick on pain of having the contract cancelled. "To accept the argument of Respondent Union that there was no mutual assent between Respondent Union and Respondent Company would be to wholly ignore the realities of industrial life and the everyday working relationships between employers and craft unions in the

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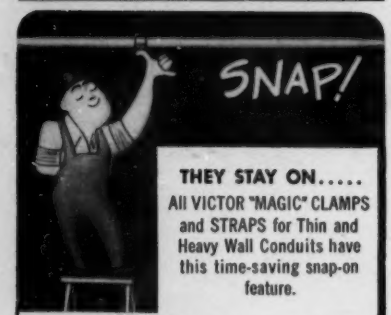

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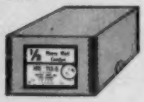

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building and construction industries," Rasbury declared. Therefore both union and company violated the Taft-Hartley Act.

As penalty Rasbury recommended that both Satchwell and Local 508 "refund any and all dues, initiation fees, assessments, permit fees, and/or "dobies" collected from each and every employee employed by said company on the Brunswick Pulp and Paper Company job during the period from February 18, 1958, through July 3, 1958."

The case came up because Gus Thornton, R. W. Moss, and Ernest F. Hayes, all electricians, charged that Satchwell had violated the law. Thornton claimed that because of Local 508's agreement Satchwell refused to hire him. Moss and Hayes claimed that because of the agreement they were laid off illegally. Paradoxically, Rasbury found that there had been no illegal discrimination against any of these three. He dismissed their complaints.

No discrimination

As we have reported previously in this column, if contractors have a hiring hall arrangement with a union the Labor Board requires: there be no discrimination because of lack of union membership; contractors have the right to hire or reject any applicant; hiring regulations be posted at the hiring hall. Contractors will be wise to check their hiring hall arrangements with attorneys who specialize in labor law.

Dome building

(Continued from page 23)

stages presented special problems."

One of the first major problems was the question of where to begin the electrical installation. In conventional type buildings, there are always routine starting points such as corners, certain locations on the walls, etc. But here was a completely circular building, rising from its broad foundations in prefabricated steel sheets in a curved design to the apex of the dome high above.

This problem was solved by setting up a transit at a point within the building and from this location everything was shot so that it provided a pivot or starting point.

Since the mode of construction was entirely new, each progressive step called for ingenious preparation by Sachse Electric, Inc. There were no past experiences or precedents to rely on, therefore much of the electrical work was more or less "engineered" at the site and worked out as the work continued onward.

Major conduits were put together in 40-foot sections and these were bent to the radius of the building, and lifted on cranes and finally bolted together in place on the inside building walls.

The major installation erected by Sachse Electric in the Union Tank Car Dome was a unique "wheel of light" which is 322 feet in diameter and consists of 106 color corrected mercury vapor lights. This assembly of lighting is suspended 34 feet above the work areas of the structure and follows radial railway tracks below.

Since every piece of the construction material was fabricated on the site, temporary electrical installations were also required at all times during the project on the building site and in other work areas.

Another unique phase of the electrical installation was the erection of a closed circuit television system in the dome which enables an operator in the control tower high up from the ground

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level to supervise all activity in the building.

The lighting facilities were so constructed in the dome that the entire work area has 70 footcandles of illumination.

The Sachse firm is particularly proud of its accident record during the construction period. With no established construction methods to follow and with its huge unsupported outer shell rising high into the air, the project could well have caused a number of serious accidents. However, the statistics bear out the fact that the contractor emphasized the safety factor to all of the superintendents, foremen and workmen on the job because this particular project turned out to be eight times safer than for an average construction job of comparable size.

High intensity light

(Continued from page 22)

room were ventilated with inexpensive "outside air" we could reduce the heat gain from fluorescent lighting by 10 to 15 per cent and thus reduce the over-all air conditioning load for buildings by 6 to 12 per cent.

Furthermore, if our lighting fixtures were equipped with two pieces of copper tubing running the length of the fluorescent fixture near its top and fastened to the outside of the fixture and if these pipes were all connected to a simple water circulating system which is pumped through a cooling tower, we could reduce the temperature in the fixture from somewhere around 125°F. to approximately 98°F. or lower. This would dissipate 60 per cent of the heat generated in the fixtures. Translated into air conditioning equipment needs for the building, this can result in a 30 to 40 per cent reduction of the total building load.

Thus, with two relatively simple measures, we can eliminate between 35 and 50 per cent of the total building air conditioning load without sacrificing one lonely footcandle.

What does 35 to 50 per cent of the air conditioning load mean in dollars and cents?

Since the air conditioning installation in a modern building is approximately 11 per cent of the total building costs, we can expect to save from $78,000 to $110,000 on the costs of a $2,000,000 building. This would appear to be a worthwhile goal for any designer.

Now, what can be done to pacify our psychologist friends?

His argument is that man is most at ease in surroundings which approach those provided by Mother Nature. Out in the farm country we see a multitude of colors and shapes with very little apparent order or linear arrangements. It is obviously impossible to imitate nature inside a building, but we can and should take a note from natures methods to put man at ease.

Instead of providing a uniformly linear and symmetrical system of long strips of lighting, we should change our patterns and provide some variety. Furthermore, we should make use of color to break the monotony in clinically designed high intensity lighted areas.

There are many ways of doing this. We can intersperse tinted plastic louvers with the common white louvers; we could place a colorful glass globe incandescent fixture here and there in large areas to provide a focal point; we can use colored or tinted diffusing plastics under our tubes placed at odd intervals in a lighting system. The designer's choice in this field is wide open and only his ingenuity and tastes can establish limits.

We can now answer our original question saying that nothing is wrong with increased intensities for indoor lighting provided we have given some thought to overcoming the increased air conditioning and ventilating problems and have given more thought, than in the past, to the human being who will be all lit up by our 200 to 300 footcandles.

Economic comment

(Continued from page 16)

Readjustments of stock prices are often alarming, particularly to the small investor, but recognition of the inherent strengths of present security values lends credence to the belief that over-all stock prices will continue to rise with the economic expansion and growth of business. Stock purchases appear to be a sound investment at the present time.

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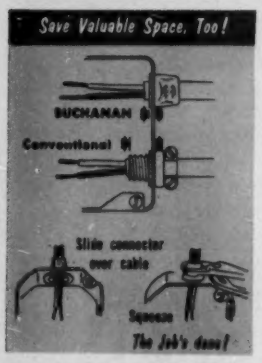

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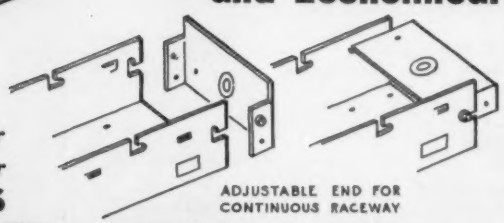

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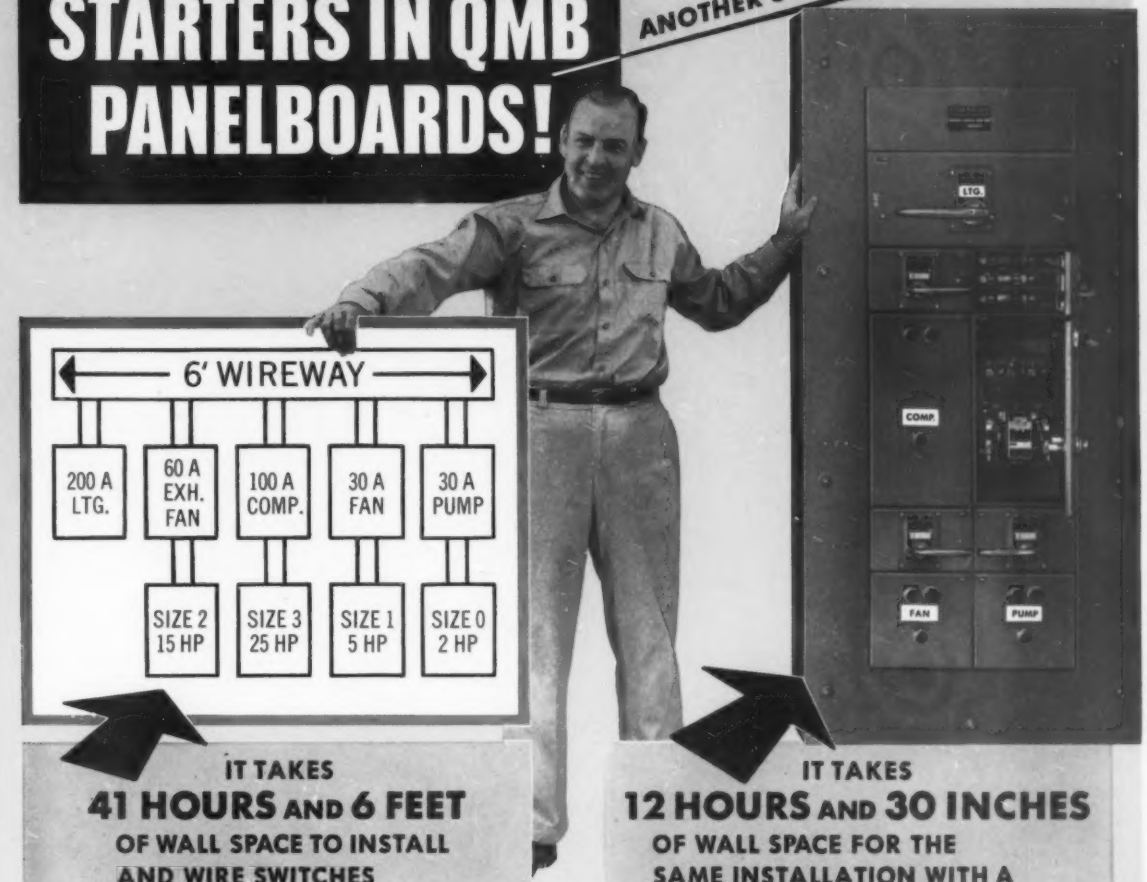

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